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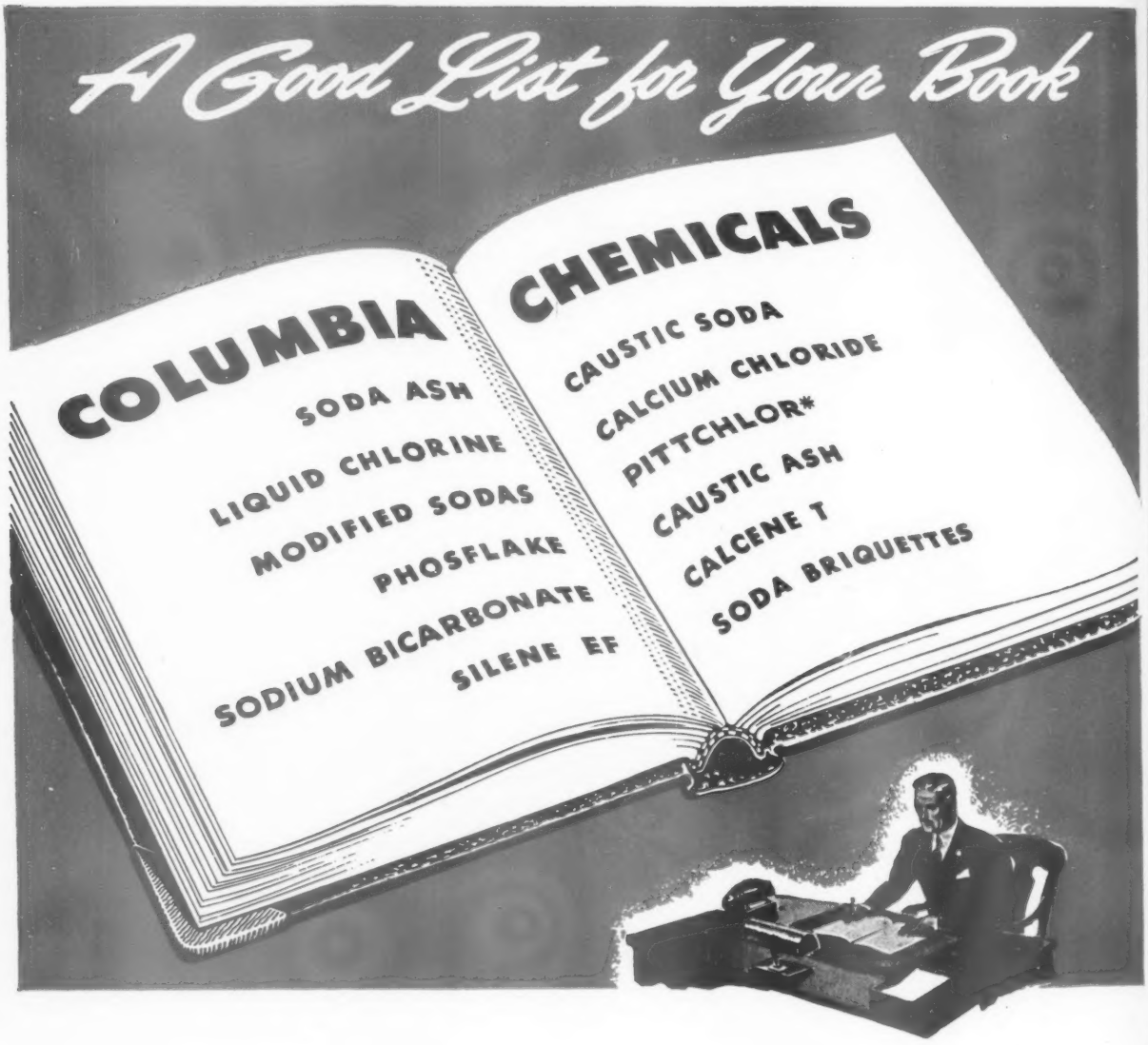

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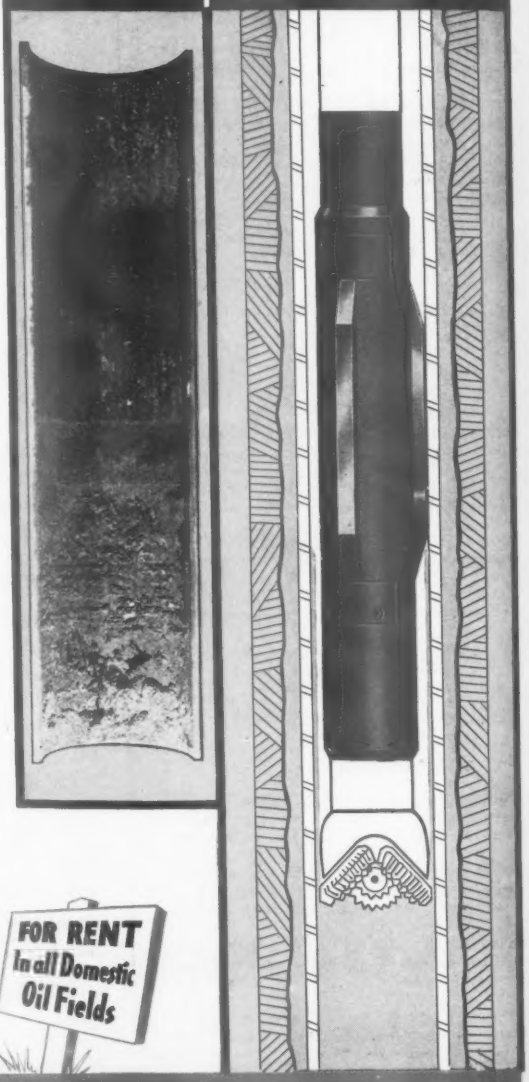

If you have ever been "all burned up" because a packer or swab would not pack off—or a cement retainer set prematurely and could not be lowered past a certain point in the casing or liner—you probably were confronted with the condition pictured at the right.

Here is a section of liner which was split to determine the reason for premature setting of a cement retainer. The reason is obvious and this photograph also reveals why packer or retainer slips will not hold properly because they become packed with cement or mud that is clinging to the walls of the pipe.

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Trends

Crude-Oil Production
By States—Page 178

CRUDE-OIL STOCKS 224,573,000 bbl. as of Oct. 6—up 2,186,000 bbl. One year ago 222,500,000 bbl.

GASOLINE STOCKS 74,608,000 bbl. as of Oct. 6—down 4,944,000 bbl. One year ago 77,585,000 bbl.

RESIDUAL FUEL-OIL STOCKS 46,059,000 bbl. as of Oct. 6—down 794,000 bbl. One year ago 64,709,000 bbl.

GAS OIL AND DISTILLATE STOCKS 42,348,000 bbl. as of Oct. 6—down 1,341,000 bbl. One year ago 44,397,000 bbl.

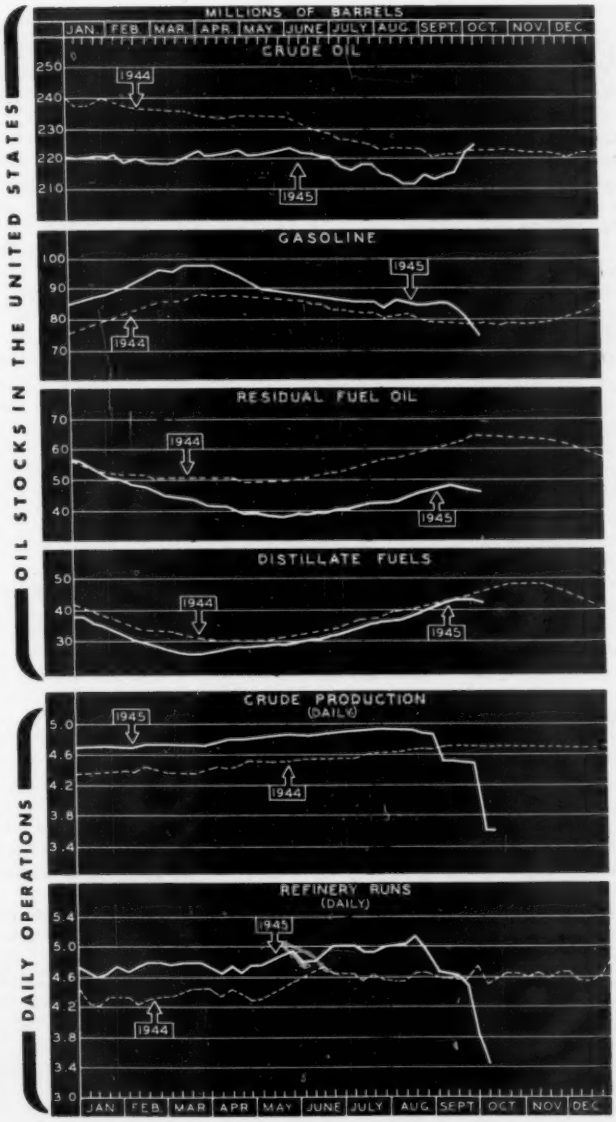
CRUDE-OIL PRODUCTION 3,618,450 bbl. as of Oct. 13—down 50 bbl. One year ago 4,721,650 bbl.

REFINERY RUNS 3,409,000 bbl. daily week ended Oct. 6—down 403,000 bbl. One year ago 4,542,000 bbl.

CONSTANT reduction in unit costs is an established trend of many years' standing in the petroleum industry. There are indications, however, that efforts along this line will be intensified during the next few years. The reasons are obvious. First, the increased cost of a man hour of labor; second, the increased cost of equipment and materials. The outlook for labor costs in terms of man hours is upward. There are hopes, probably based on sound assumptions, that the wartime trend of increases in costs of equipment and material may be checked, or even turned downward slightly. Although reduction in unit costs would seem unlikely in view of these basic conditions, actually the industry throughout its history has demonstrated its ability to overcome obstacles.

INCREASED man-hour costs can be overcome only by a more-than-compensating increase in man-hour productivity. Three basic principles are involved in achieving this goal. All require additional investment in the tools and equipment used by the worker. One of the cheapest, in the long run, and simplest, is more intelligent training. Skilled and objective job analysis, coupled with effective education of the worker, has been expanded rapidly during wartime shortages of skilled labor. Carried into the postwar period and used on workers of higher intelligence, skill, and natural ability than were available during the war, good results should be achieved. The next cheapest, in the long run, and often very effective, is research that makes maintenance and replacement work unnecessary. Elimination of corrosion, thus ending the labor of replacement of equipment items, is a good example.

BUT in the long run, the greatest increase in man-hour productive output will probably come, as in the past, through investment in new, often costly, but always more efficient equipment. Rapid writeoff of capital equipment and replacement by newer and more efficient equipment is one of the earmarks of a progressive industry. It is characteristic of both the petroleum and automotive industries. Both display a strong, steady trend toward higher capital investment per man-hour of labor employed. With higher man-hour costs, the trend toward heavier capital investment per worker will probably be accelerated.



Reford Bond, chairman, Oklahoma Corporation Commission, left, is testifying. Others in picture are J. Gimelli, court reporter; Commissioner Harrington Wimberly, new member from Altus, Okla., and Commissioner Nelson Lee Smith, presiding chairman

Natural Gas Needs No Further Regulation, FPC Is Told

OKLAHOMA CITY.—The natural-gas industry needs no further federal regulation, Federal Power Commission was told here last week by witnesses appearing at the second of five regional hearings scheduled for the Midwest to investigate all phases of natural-gas operations.

Keynoted by Gov. Robert S. Kerr, who expressed his "unalterable opposition to any extension of federal control over the oil and gas industry within the state," officials of the state Corporation Commission presented voluminous testimony designed to show that state direction and regulation had served the public and the industry well, and that control vested in a federal agency was not required.

Commissioner Nelson Lee Smith, presiding, was assisted by the new Oklahoma commissioner, Harrington Wimberly, sitting in his first case, and by Marvin Farrington, examiner. Chief crossexaminer of witnesses was Tom J. McGrath, Washington lawyer, representing the railway and miners' unions. Other active crossexaminers were Amos M. Matthews, representing Association of American Railroads, and Leland Richardson, attorney, representing the State of Louisiana.

Reford Bond, chairman of the Oklahoma Corporation Commission, followed Governor Kerr with a historical discussion of Oklahoma's oil and gas conservation measures, to which was added a summary of current efforts with respect to production, waste, and conservation. His testimony stirred fresh interest, especially among Louisiana observers, when he said: "This does not mean that the state may not control the production of gas within the state so as to prohibit its waste or the wasteful utilization thereof out of the state. A state has the power to preserve its natural gas for the equal use of all. If a state has no control over the production of gas for wasteful out-of-state uses, then it could have no power to preserve its gas for the equal use of all. Such a wasteful out-of-state use could readily dissipate all of a state's gas reserves while the state stood idly by, powerless to act."

This statement resulted in Bond being recalled for crossexamination by McGrath, for further elaboration on his end-use views. Bond suggested a federal law, similar to the Connally Hot Oil Act, affecting natural gas, which would empower FPC to sustain Oklahoma in saying that Oklahoma gas could not be used out of the state for purposes for which its use is prohibited within the state.

Price Theme Emphasized

Representative Ross Rizley, of the Eighth Congressional District of Oklahoma, emphasized the price theme in his testimony. He said that "the uncertainty as to price and more particularly the differentiation in price by the several companies producing in the field, have resulted in much dissatisfaction among the landowners, and they are much interested in trying to get, not only an adequate price, but a uniform price established."

Gas reserves and production in Oklahoma were discussed by Elmer Capshaw, gas engineer for Oklahoma Corporation Commission. Capshaw placed reserves in the state at the first of this year at 8,829,053,000,000 cu. ft., which, at the 1944 rate of production, would give the reserves a life of 45.6 years. He added that these reserves did not include several important discoveries made in 1945 which probably could account for ½ to ¾ of a trillion cubic feet additional.

Don McBride, chairman of Oklahoma Planning and Resources Board, expounded the policy of free trade among the states in all natural resources. "Where would we be now," he asked, "if state barriers had hindered the nation-wide use of coal, iron ore, copper, lead and zinc, and other natural resources which are usually found concentrated in localized areas?" Under sharp crossexamination attempting to develop the point that if Oklahoma permitted transportation of its natural gas to distant markets the state would shortly find itself without adequate fuel supplies at home, McBride maintained that new additional reserves would be discovered, and eventually the country may be using atomic energy.

Geological problems involved in connection with gas produced with oil were presented by Dan Howard, petroleum geologist employed by the Corporation Commission. He was followed by Walker T. Pound, chief conservation officer for the state, who gave important detailed testimony regarding activities and administration of his office. In agreement with other expert testimony, he stated that "in the conservation of oil and gas no more effective agent has yet been found than an adequate price."

On the subject of waste, Pound said: "Insofar as the physical waste of dry natural gas is concerned, there is none in Oklahoma. With respect to gas producing, or produced with, oil, while some of it is being vented, such gas is serving the useful and principal purpose which nature intended it to serve. Gas produces oil, and some gas is produced with all oil. So long as efficient production practices are being followed, conservation is being practiced, for to conserve does not mean to hoard. It is true that in the major fields in Oklahoma approximately 85 million cubic feet of gas per day is available for further

utilization. This includes gas vented at wells and at gasoline plants.

"Due partially to the fact that only 5 per cent of the casinghead gas produced in Oklahoma is sour gas, 82 per cent of the gas produced from major oil fields in Oklahoma goes to either gasoline plants, pipe lines, or is used in the field. The average gas-oil ratio in these fields is 1,287 to 1. Only 10 per cent of the tail gas from gasoline plants is being vented. We consider this a remarkable record in conservation and further utilization of gas. In every one of these major oil fields, plans have either already been made, or are being made to use the 18 per cent of gas now being vented. The purchasers of gas have in practically all instances been helpful and cooperative in working out these problems."

John F. Gallie, geologist for Cabot Carbon Co., testified on the use of natural gas for carbon-black manufacture. Lawrence R. Alley, chief clerk for the Corporation Commission, introduced maps and statistics relating to dry and wet gas, and went into matters of pipe-line costs, storage problems, and taxes paid to Oklahoma by pipe-line companies.

State Chemist George S. Cupit dispelled any fears over use of natural gas for manufacture of plastics and other synthetics. He said that only 1 per cent of the gas is used for these purposes, excluding carbon black, and that further development of these chemical derivatives will not have much effect on the consumption of natural gas.

Testifying on the last day, Vernon F. Taylor, president of Peerless Oil & Gas Co., San Antonio, criticized the practice of purchasing gas on the basis of 2 lb. above atmospheric pressure, contending that this gives pipe-line companies a substantial quantity of gas for which they do not pay. He embraced Bond's suggestion that gas should be included under the Connally hot-oil law, recommended divorcement of producing properties from transportation activities, and suggested a formula for a fair price based on what the gas could be sold for in the eastern industrial areas, less the transportation cost. Taylor and Frank Parks, Hooker, Okla., independent gas producer, who was the last witness, told the commission that a better price was needed to solve the independent producers' problems. Parks stated that competitive pipeline markets were needed in some places.

The next hearing will be held at New Orleans beginning Monday, November 12. This is a change from the date originally set, October 30, which came into conflict with a Navy program honoring Admiral Nimitz.

Regulation for Plants in Navy Hands Subject of Conference

WASHINGTON.—With the U. S. Navy in technical possession of about 33 per cent of the country's oil-refining capacity — sequel to strikes which had crippled the industry—reports this week showed that most of the affected plants were in normal operation again. Virtually all the 43,000 strikers returned to their jobs, pending settlement of disputes, when the Government took over. Conditions under which the plants are to be operated were being discussed by Navy and company representatives.

O. A. Knight, head of the Oil Workers International Union, had said his organization would try to open negotiations directly with the Navy in an effort to gain the wage increase of 30 per cent demanded in compensation for the loss of overtime pay attending cessation of the war. The week's developments, however, disclosed no intention on the part of Government representatives to act as principals in such bargaining.

There has been no recession on the part of the oil companies from their stand that the strikes were unjustifiable and in violation of contracts. Many companies voluntarily increased wages 15 per cent. A statement that the companies had refused to submit wage differences to arbitration drew a barb from Sen. Joseph H. Ball, of Minnesota, who described Secretary of Labor Lewis B. Schwellenbach's arbitration proposal as "a phony."

Employer "Would Be Nuts"

"The union demanded a 30 per cent increase," said the senator. "Secretary Schwellenbach said to the companies, 'Give your employes the 15 per cent and then submit to arbitration the difference between the 15 and the 30 per cent.' Any employer accepting such a proposal would be nuts."

"The fight of the union against wage cuts and for reduction of the work week will continue," said J. T. Goodwin, secretary of the union's District 4 council, in a statement issued from his headquarters in Houston. "It is our contention that through reduction of the work week, with the same take-home pay, returning veterans and war workers will have greater opportunity to get jobs which will insure decent living conditions."

The Navy's program, as formulated under the direction of Vice-Adm. Ben Moreell, established district headquarters in Houston, Chicago, New York, and Los Angeles. One naval officer and two shore patrolmen are stationed at each of the plants seized under the order issued October 5 by President Truman.

Representatives of eastern refineries involved in the controversy met Navy officials in New York October 12 for consideration of conditions under which seized plants are to be operated during the expected 2 months of Government supervision. Similar regional conferences were to be held at Houston, Chicago, and Los Angeles.

The tentative agreement discussed is similar to that adopted in other seizures by the Government. Naval officers said its form had been found satisfactory and that no departures from it would be encouraged.

The agreement provides continuation of normal company business, with officials and supervisory employes maintaining their customary relationships, subject to modifications by the naval officer in charge.

All business and operations are to be financed by the company and conducted for its account, the Government having no claim to proceeds. No obligations previously incurred by the company are to be assumed by the Government.

The company is not to make commitments on behalf of the Government, nor shall the company or its agents represent it as acting for the Government. The fact that a plant manager or employe has been named manager for the Government is not to be represented as indicating the company is acting for the Government.

The company is authorized to use all plant facilities in normal fashion and to keep complete records of accounts covering business relating to the plant during the period of Government possession. These records are to be kept for 6 years, unless permission is given to make earlier disposition of them.

The company is to be governed by legal and proper decisions and directions of the naval officer in charge in matters of labor relations and policy, and all developments relating to them are to be reported to him or his representative.

The company assumes all risks of loss or damage to plant and facilities, with Government and agents in no event liable.

The company is to indemnify the Government and its agents in case

XUM

Unions Will Clamor for More, Says Sinclair

NEW YORK.—H. F. Sinclair, president of Sinclair Oil Corp., in a letter to stockholders reporting on the recent strike for a wage increase of 30 per cent, predicted unions will make additional demands for extra pay for night work, more paid holidays, sick-leave pay and termination pay, and that as soon as the 40-hour week is established will demand a 36-hour week or less with no reduction in pay.

"Under the 48-hour week," Sinclair said, "common labor at 98 cents an hour is making $216 a month. Stillmen, at the top of the wage bracket, getting $1.52½ cents an hour, are receiving $343 a month, and at the average rate for refinery labor—$1.27 an hour—employes make $286 a month.

"It is such hourly rates as these that were, under the union demand, to be increased 30 per cent. We do not intend to discuss the moral, economic, and inflationary aspects of this strike, although these considerations cannot be overlooked."

In a labor dispute which had no direct relation to the refinery strikes, pickets were stationed at oil leases in West Texas following a vote of drilling department members of the oil workers union to strike for recognition of the union and granting of collective-bargaining rights by American Association of Oil Well Drilling Contractors. Oil companies said no rigs were shut down as a result of the union action.

The strike was called off October 13 after C. Massengale, director of the organizing campaign, had been notified by Dr. E. A. Elliott, regional director of National Labor Relations Board, that a conference between the union and the board had been asked by Washington.

of liability connected with possession of the plant.

The company is to have no claims against the Government or its agents by reason of the seizure or acts taken under it.

Neither the seizure nor any stipulation in the contract is to modify any contract between company and Government, or between company and any Government contractor pertaining to production of war material or limit any other rights of Government respecting limitations of profits or control of prices.

No agent of the Government is to make any commitment purporting to bind the company, except that this shall not limit the right of the secretary of the navy to act in accordance with the War Labor Disputes Act and other statutes.

If the officer in charge acts so as to increase company risks or obligations the company may record its position and objections with the officer. The Government is to be responsible for such increased risk or obligation to the extent of damage suffered by the company.

The agreement may be terminated on 5 days' written notice by the officer in charge or by the company, but all provisions are to remain in force as to all transactions occurring prior to the effective date of such termination.

Sentiment in favor of new congressional antistrike legislation has increased noticeably in the past few days. "In the face of our desire to help labor, labor is going on strike," declared Representative Robertson, of Virginia, on the floor of the House. "We have put all the powers of the Government behind any union demand to make a corporation live up to its contract, but have not put any legal responsibility on unions. If we are to avoid labor friction that may hinder and possibly defeat successful reconversion, the Wagner Labor Relations Act should be amended to provide for mutuality of responsibility between employes and employers."

Airplanes and Submarines May Be Used in Search for Oil

WASHINGTON. — Specially equipped planes, and even submarines, may be used to explore for oil and other minerals in the continental shelf off the coasts of the United States and its territories, according to experts of the Department of the Interior. Pending action by Congress, President Truman has turned over to the secretary of the interior the administration of these vast resources.

Secretary Ickes has asked the Geological Survey to make recommendations for a survey of the submerged area, which is more than 750,000 sq. miles in extent—nearly 50 per cent larger than Alaska. Pointing out that technology has now advanced to the point where underwater structures may be located with accuracy and that drilling methods may be successfully adapted to tapping underwater oil resources, the department's experts say that extensive investigation of the submerged land areas adjacent to the United States appears justified.

Geological surveys of submerged areas have already been satisfactorily made by seismic methods, and other methods are available. One company has made a systematic seismograph survey to a distance of 26 miles off the Louisiana coast.

Methods suggested for surveying the continental shelf include: (1) Magnetic surveys, which can be made rapidly from airplanes and can furnish information on the magnetic properties of subsea formations and aid in recognition of structural features. (2) Gravimetric surveys, on the sea bottoms, made in submarines, which would locate salt domes. (3) Refraction seismic surveys, made from boats and barges and instruments placed on the sea bottom, which would locate shallow salt domes and shallow beds for establishing stratigraphic reference planes. (4) Reflection seismic surveys, made from boats or instruments on the sea bottom, which would locate deep salt domes and major structural features associated with oil deposits.

The continental shelf in the Gulf of Mexico offers greatest present promise of oil-bearing structures, but there may be additional areas of the shelf off the Pacific Coast, with promise of oil, and there are indications that oil-bearing structures might be found off Alaska. There is a strong probability that oil-bearing strata may extend 100 miles into the Gulf of Mexico, Department of the Interior experts said.

Petroleum production in the Gulf Coast region of Louisiana and Texas began with the famous Spindletop dome near Beaumont, Tex., in 1901. Since that discovery, hundreds of salt domes and related structures have been located in the area. Since geophysical prospecting began in the middle twenties and, particularly, since the introduction of the reflection seismograph in 1931, geologists have been so successful in finding new production in the region that it now contains approximately one-fifth of the nation's proved oil reserves.

Large and productive salt domes along the coast and the extension of prospecting into the marshes, bayous, lakes, and coastal bays of Louisiana made it evident that the oil-productive province extended beneath the Gulf.

THIS WEEK

VISION—Specially equipped subs and planes expected to hunt for offshore oil. . . . Gulf Coast offers brightest promise, but Alaskan waters may yield riches. . . . Deposits 100 miles out in Gulf declared likely. . . . ¶Tulsa engineer says radioactive byproducts in manufacture of atomic bomb could be used in well-survey equipment to locate oil zones in wells now cased off. . . . Might recover vast stores left undisclosed by former drilling procedure. . . . ¶Oil companies owning pipe lines considering air patrol, employing Air Force veterans. . . . One plane could cover in a day as much as several men on ground could cover in a week. . . . ¶Chairman Oklahoma Planning Board prophesies atomic or other power will be available before state's immense natural-gas reserves are depleted. . . .

FOREIGN—England to continue gasoline rationing indefinitely. . . . Blow to automobile manufacturers, service-station owners, who expected early removal of restrictions. . . . ¶Prewar production of 650,000 tons of rubber annually in Dutch East Indies estimated available within a year. . . . Foreign lands explored for oil by 105 United States geophysical crews, compared with 64 a year ago. . . . Caribbean area most active, with 61 parties. . . . Russia doesn't want American crews, but wants to buy 40 sets of seismograph intruments at $20,000 to $40,000 a set. . . . ¶Arabian American Oil Co. to build 1,000-mile pipe line from Saudi Arabian fields to Palestine. . . . Predicts United States will import 1,000,000 bbl. of oil daily within 5 years. . . . ¶Army and Navy Liquidation Commission sells 40,000 used tires to Italian Government. . . .

HEADACHES—Shortage of hotel accommodations threatens to limit attendance at A.P.I. convention. . . . ¶Major oil companies wrestling with perplexities of amortizing cost of war facilities. . . . ¶Physicist tells Senate committee that within 20 years a button pushed in Russia might destroy all human life in United States. . . . Russian science booming. . . . May soon be ahead of this country. . . . ¶Investigation of Houston's city-owned natural-gas plant demanded. . . . Alleged to charge 25 per cent more than privately owned plants. . . .

STRIKES—Navy and oil companies confer over rules governing operation of plants seized by Government. . . . Senator Ball calls Schwellenbach's arbitration proposal "phony." . . . Any employer accepting it "would be nuts." . . . ¶Strike of drilling crews in West Texas called off pending conference with NLRB. . . . Recognition of union and bargaining rights demanded. . . .

PRODUCTION—Drop of only 50 bbl. recorded in country's daily crude output. . . . Total 3,818,450. . . . Kansas up 18,450. . . . Substantial gains in Wyoming and Illinois. . . . Offset by slump of 24,650 bbl. in Oklahoma and losses in California and eastern area. . . . ¶Week's completions 485, down 67. . . . ¶Standard of New Jersey selects area along North Carolina coast for exploratory drilling. . . . Main purpose is to get picture of underground formations. . . . Oil search there going on for 20 years. . . . ¶Opening of new pool makes Concho 176th county in Texas to produce oil. . . . ¶Alabama, having joined roster of producing states, establishes board to regulate oil and gas operations. . . .

WASHINGTON—Ickes confident Senate will accept revised Anglo-American pact. . . . "Our nationals can dispose of products in Middle East in an honest-to-Betsy competitive market—not a chamber-of-commerce market." . . . ¶Senate committee says gross profit of two big-inch lines up to June 30 was $135,000,000. . . . Cost Government $142,000,000 to build. . . . ¶FPC is told at Oklahoma City natural-gas hearing that the industry needs no further federal regulation. . . .

Welding and ditch digging in Russia for constructing the 500-mile system of 16 and 18-in. pipe from Saratov, in the Ural Mountains, to Moscow for transmitting natural gas from reserves of the Yelshansk area near Saratov. Construction started this spring on the project scheduled for completion before the end of this year. Compressor equipment consisting of 36 1,000-hp. units and other heavy-duty machinery for the line have been purchased from manufacturers in the United States

Sovfoto

C.N.G.A. Discusses Reconversion Problems at Fall Meeting

by L. P. Stockman

LOS ANGELES.—The 20th annual fall meeting of the California Natural Gasoline Association, held in the Biltmore Hotel, October 12, was devoted to discussions of postwar problems confronting the producer, refiner, and natural-gasoline manufacturer. The program was well balanced and instead of being limited to immediate problems was devoted also to the subjects uppermost in the minds of those interested in converting from a wartime basis to normal operation.

E. W. McAllister, chief engineer of Western Gulf Oil Co., discussed condensate reserves which are rapidly becoming an important factor in California. H. A. Gehres, vice president of Cooper-Bessemer Co., outlined recent advances in both refining and production technology which require the compression of gases to extremely high pressures. This requirement presents many problems to the designer of compression equipment. It was pointed out that some years ago the C.N.G.A. had a standing subcommittee on compression but that in recent years it has not been active.

Since this committee ceased to exist, operating pressures have increased enormously and much research has been necessary to explain behavior at these higher pressures.

M. M. Perkins, process engineer of M. W. Kellogg Co., discussed the utilization of propane for motor-gasoline manufacturer and in addition to reviewing the processes available for converting these products into motor fuel revealed the importance of propane and butane when used as feed stocks for the various processes.

F. D. Parker, consulting engineer, presented an informal review of the technical and economic factors involved in the conversion of aviation gasoline plants to peacetime use. The aggregate value of these plants involving catalytic cracking, alkylation, and isomerization, was placed at $850,000,000.

Fred Hartley, of Union Oil Co., presented a resume of the processing methods employed by that company during the war to synthesize toluene from crude oil and natural gasoline and to separate the synthetic toluene from paraffinic and naphthenic hydrocarbons of approximately the same boiling range.

M. L. Arnold, of Richfield Oil Corp. and C.N.G.A. president, pointed out that in planning for the production of fields by pressure maintenance or by cycling, cooperation is required between the engineers of the producing and the natural-gasoline divisions to insure the installation at a minimum cost of ample facilities for the production of the field. This requires an understanding by the gas-department engineers of the principles of reservoir control and operation. It also requires an understanding by the production engineers of the limitations inherent in pipe-line systems and absorption and compression plants.

After pointing out that members of the association are kept up to date by the physical-constants and the gas-measurement committee, Arnold recommended that more attention be devoted to compression and pipe-line flow of gases, computation of vapor-liquid equilibria, as well as computation of the number of plates required for strippers, fractionators, and absorbers.

Attendance was good at the technical sessions and tickets for the evening banquet and stag show were sold out several days ahead of the meeting.

M. W. Kibre, of General Petroleum Corp., is vice president of the association, and George L. Tyler is secretary-treasurer. The fall meeting committee consisted of W. L. Rifenberick, chairman, and E. A. Brock, of Southwest Welding Co.; C. E. Gotterba, of Richfield Oil Corp.; M. W. Kibre, ex officio; Fred Hartley, of Union Oil Co.; C. L. Hutchings, of Tide Water Associated Oil Co., and R. S. Ridgway of Standard Oil Co. of California. Kibre presided at the morning technical session and Rifenberick presided at the afternoon session.

Tom Taggart, of Standard's natural-gasoline department, was down from San Francisco to attend the meeting and renew acquaintances. Taggart is a past president of the association and was one of its founders. Herbert Eggleston and P. S. Magruder, of General Petroleum Corp., both past presidents, were also present at the technical sessions. Magruder, director of manufacturing of General Petroleum, told members that the biggest problem confronting the industry at present was the use of the lighter hydrocarbons. He felt that the L.P.G. industry would quickly return to its former position of importance in California and that this outlet would take part of the butane production while some additional quantities would be used to produce motor fuel and some used as charging stock.

Magruder told refiners they must find a market for butane and propane or the natural-gasoline manufacturer would find his own market. In addition to the L.P.G. industry providing an outlet for butane and propane, it was suggested that these hydrocarbons be used in the production of synthetic chemicals and plastics. The importance of butane as a motor fuel remains to be determined although a number of trucks will undoubtedly be equipped to use butane-propane mixtures at an early date. During the war period some automobiles were equipped to use butane but this was stopped because of the demand for butane.

E. W. McALLISTER

FRED HARTLEY

McAllister, chief engineer, Western Gulf Oil Co., presented a paper on "Phase Behavior to Evaluation of Condensate Reserve," and Hartley, Union Oil Co., presented a paper on "Commercial Synthesis of Toluene by Hydroforming and Recovery by Azeotropic Distillation," at the C.N.G.A. meeting

Hotel-Room Shortage May Cut A.P.I. Attendance

NEW YORK.—Serious shortage of hotel accommodations in Chicago may limit attendance at the twenty-fifth annual meeting of American Petroleum Institute, according to William R. Boyd, Jr., president of the Institute. Hotel reservations for directors, councillors, and members of Institute committees that have been called upon to meet will be given precedence by a special housing committee. All applicants for reservations are asked to indicate such membership and those who have applied previously are requested to make a new application.

"This is an extraordinary request," Boyd said, "but in view of the congested hotel situation everywhere, nothing else can be done. It is important that the meeting be held and this is the only way to do it."

FOUNDED IN 1910

BY PATRICK C. BOYLE

The OIL AND GAS JOURNAL

Memo to Historians

NEXT week marks the final meeting of the Petroleum Industry War Council. There will be a victory celebration, which is fitting and proper. But this will be only the beginning of an important phase. Thereafter the field belongs to the historians, whose task it will be to interpret the hidden meanings and implications of the work done by the PIWC and its companion organization, Petroleum Administration for War.

The war from which we have just emerged was a crucible in which our men and our system were tested as no nation and its system ever previously had been tested. We emerge a colossal nation, amazed at our own strength. That strength is not accidental. Its sources lie in the kind of men we breed and the environment in which they grow. It is vital to our future national welfare that the Congress and the people receive a report from the historians on this subject.

PIWC, its district advisory committees, with their multitude of subcommittees, which never made the headlines; PAW, with its district offices and its rank and file—all of these may well be surprised at the prominence they will receive in this new type of history.

Certain facts should be noted for that record. They involve two men, Harold L. Ickes and Ralph K. Davies, their relations with the petroleum industry and with each other. The role of Wm. R. Boyd, Jr., and his relationship to these two men will provide another record, complete in itself.

Ickes and men in the petroleum industry often differed violently before the war. They may do so again. But when they agreed to work together during the war, certain mutual covenants were made. They have been kept. Between Ickes and Davies certain pledges were exchanged. These also have been scrupulously observed. Let the historians note that it was these things that made possible the efficient teamwork that helped to win the war.

Davies stands today as a living symbol of the petroleum industry's part in this war. Our industry, like the nation, emerges from the war amazed at its own achievements. But oil men marvel even more at Davies. A slight physique turned out to be slender only as a finely tempered steel blade is slender. Week after week, month after month, it withstood incredible hours of grueling work and crushing burdens.

During his career as an oil man, Davies developed a keen, analytical faculty of breaking complex problems into their component parts. He also developed an orderly system of solving these problems by coordinating the efforts of many men, along with the executive follow-through to see that the attack did not cease until the objective had been achieved. These are not common gifts.

The thing that puzzles is where and how this man developed that cold inner flame that burns so fiercely. It has a quality that enabled him calmly and coolly to ask oil men to accomplish apparently superhuman war tasks. In the face of seeming disaster, his indomitable will and icy courage never failed. Oil men never found any surface evidence of inner fear that they might fail him, even when the things he asked for looked impossible.

This man is a symbol. Let the historians search his career for the reasons. When they are found, we shall have a better understanding of the sources of our national greatness.

XUM

Merle Becker, McBride Oil Co., St. Louis; A. S. Ritchie, McPherson Drilling Co., Wichita; Wirt Franklin, Oklahoma City; Russ M. Blodgett, Oil Producers Agency, Los Angeles, and W. J. Sloan, Sloan & Zook, Bradford, Pa.

I.P.A.A. Considers Problems Attendant to Conversion to Peacetime Operation

by Neil Williams and Charles J. Deegan

DISCUSSION of the many problems facing the domestic oil industry during its reconversion from wartime to peacetime operation filled the program of the sixteenth annual meeting of the Independent Petroleum Association of America in Tulsa, October 14 to 17.

Some of the more important problems discussed are not entirely new but in the light of changing world markets and supplies, and uncertainties in economic, governmental, and production trends arising with the close of the war they were looked upon as being accentuated and demanding of greater consideration and more intensive efforts to meet them than ever before.

Chief among the problems expressed at the meeting were those concerning the large potential foreign reserves and possibilities of increased imports in competition with domestic oil. It was emphasized by speakers that too much oil in international trade will mean a fight for world markets which will result either in a complete loss of this country's export market or entering of this country's oil in price competition with lower-priced foreign crude.

Orderly offering of oil in international trade and limitation of imports of foreign oil into this country to such a quantity as needed to supplement domestic production were presented as solutions to the problem.

"To maintain a strong domestic industry we must have both an adequate market and a fair price structure for our oil," Ralph T. Zook, retiring president of the association, declared in his keynote address.

The Anglo-American oil agreement recently signed in London was proclaimed as a major achievement and assurance of protection for the industry of this country.

Concern was indicated over the need for creating an industry with sufficient reserve producing capacity to guarantee self-sufficiency of the nation in any future emergency. It was recommended that the industry determine the most efficient rate of production in all areas and establish production allowables accordingly. A close balance of supply with demand is essential to prevent waste, it was emphasized. Proposals were made that Interstate Oil Compact Commission and other agencies study currently decreasing demands for petroleum with a view toward taking action that would build up adequate reserves. In this it was urged that no restrictions be placed on stripper wells that would be detrimental to continued efforts toward conservation.

Other matters receiving the attention of the association were the need for taxation adjustments, labor relations, manpower, prevention of any extension of authority of federal government agencies to usurp conservation powers exercised by the various states, legislation of the federal Government as to the title to tidelands and lands beneath navigable waters, and the continental shelf, bills affecting public lands leasing terms and policies now before Congress, and means of accomplishing through the Interstate Oil Compact Commission and other agencies education of the public and federal government officials on matters affecting the welfare of the oil industry.

New Officers Elected

New officers elected at the I.P.A.A. meeting for the ensuing year are as follows: President, Maj. B. A. Hardey, Shreveport, La.; executive vice president, Harold B. Fell, Ardmore, Okla.; general counsel, Russell B. Brown, Washington, D. C.; executive manager, C. E. Buchner, Tulsa, and treasurer, N. T. Gilbert, Tulsa.

Stripper Well Group Elects Officers

The National Stripper Well Association, meeting in conjunction with the I.P.A.A. convention, elected H. M. McClure, Alma, Mich., president, to succeed Howard J. Whitehill, of Tulsa. McClure also is chairman of the Michigan Oil and Gas Board, Mount Pleasant. N. W. Shiarella, Owensboro, Ky., was chosen vice president; Harold B. Fell, Ardmore, Okla., executive vice president, and Fred Sehmann, Wichita Falls, Tex., secretary-treasurer.

Conservation of petroleum reserves underlying stripper wells was the chief concern of this group. Proclaiming that enormous reserves of

oil in the United States are available for secondary recovery but that present methods are relatively undeveloped and unefficient, resolutions were adopted proposing that a long-time program looking toward the recovery of these reserves be placed in the hands of the Bureau of Mines. The resolutions stated that since the ownership of these reserves is in the hands of many small owners, making an aggressive search for new methods by the operators impossible, the effort to improve the situation is a function of the federal Government.

Resolutions adopted at a previous meeting in Fort Worth last January that "efforts be made to prevail on Congress to enact a law which would grant a fixed differential in the price per barrel for stripper well production over and above the general market price, and that such additional payments be made out of a general fund" were reaffirmed.

The original action was taken "in the interest of conservation of an irreplaceable natural resource essential to the economic and general welfare of the nation." The readapted resolution stated that postwar changes in the economic situation and price levels of the nation make it increasingly imperative that such provision be made to protect stripper-well reserves. Officers of the association were instructed to proceed in furtherance of the objectives.

Responsibility of Independent Operator

By RALPH T. ZOOK
President, I.P.A.A.

Abstracts of several papers and committee reports presented at the Tulsa meeting of the I.P.A.A. are published on this and the following several pages. A paper by William B. Heroy will be published in a later issue.

OIL that is produced in one locality influences production and price in another area. Oil offered by Texas and Louisiana influences the entire crude-oil market of the United States regardless of where produced. Similarly, crude oil offered in international trade, regardless of source, affects the market for oil from the Gulf Coast fields. If too much oil is offered in international trade, it will mean a fight for the world market, or competition with low-price foreign production. Either of these would be disastrous to our industry. It is for these reasons that the speaker has been so interested in an international oil agreement. It is highly important that a sound world policy on oil be developed.

Previously, the speaker has stated the opinion that an international agreement by which oil could be offered in an orderly manner in international trade would be desirable. It is believed that the present agreement is such a vehicle.

In looking at the domestic picture, the question of price is paramount. In order to have a strong domestic industry we must have both an adequate market and a fair price. One is worthless without the other. With a current decrease in domestic demand of 750,000 to 1,000,000 bbl. daily, a critical period has developed. During this interim the action of state regulatory bodies will have a most important bearing on the entire oil industry. If they act courageously and fearlessly to bring production in line with actual consumptive demand, they will have performed a great service to the industry and to the nation.

Industry, however, must also do its part. The present situation calls for leadership of the highest caliber on the part of major oil companies now that crude oil is available in amounts above requirements.

In the past, before various groups, the speaker has outlined what he considers to be a sound program for the oil industry. To accomplish the results of such a program is the fundamental aim of the domestic industry.

Government controls, which have been enforced during the period of the war emergency, are rapidly being relinquished. This freedom for which we have clamored so long can be helpful or harmful.

Report of the General Counsel

Russell B. Brown

THE producer of petroleum is primarily interested in three fundamentals. Price for his product supplies capital for his operations; market outlet enables him to sell his product; the tax element of his costs determines to a large extent what portion of his proceeds he may devote to further development. Above all else, we must preserve a proper basis of price, market, and taxes.

Imports once more are the greatest immediate problem we face. During the war our Government has given encouragement to the development of oil resources in several foreign countries. While this was a necessary measure, the end of the war left a large producing capacity and we are now seeing consistent increases in imports. The solution is in the hands of a few companies in the United States, some of whom have expressed themselves as favoring an imports program that will not injure the domestic industry.

The independent producer of oil is also in many instances a producer of natural gas. He has a direct interest in the investigation now being made by the Federal Power Commission. The purpose of the present inquiry remains, to many of us, uncertain.

Legislation regarding the title to tidelands and lands beneath navigable waters has been passed by the House but Senate hearings have not been held. In the meantime it is well to give some attention to the continental shelf which was the subject of an executive order on September 28.

The disposal of surplus property is proceeding on a large scale. Of direct interest is the question of Government-financed pipe lines and

Howard J. Whitehill, Tulsa, retiring president; Fred Sehmann, Wichita Falls, Tex., secretary-treasurer, and H. M. McClure, Alma, Mich., newly elected president, National Stripper Well Association

Warwick Downing (left), Denver, and Charlton H. Lyons, Lyons & Prentiss, Shreveport, La.

Jake L. Hamon (left), Cox & Hamon, Dallas, and Charles F. Roeser, Roeser & Pendleton, Inc., Fort Worth

tankers. Bills affecting public lands leasing terms and policies are before the House and Senate, for the purpose of liberalizing leasing and encouraging development.

So far as we here in Washington are concerned, our job will still require energy, integrity, and willing men. We will apply these attributes to the solution of our new problems.

How I.P.A.A. Can Help The Compact

By EARL FOSTER
Secretary, Interstate Oil Compact Commission

ONE of the greatest single factors contributing to the success of the oil compact has been the unfailing support of the Independent Petroleum Association of America. The way that association can be of the most help in the future is to continue that support and cooperation. Through its various committees and its entire membership, I.P.A.A. can render invaluable assistance in generating and enhancing public interest in the work of the compact. I.P.A.A. can aid materially in promoting the principles of the compact in those states not now members, and can exert much influence for good in bringing new oil-producing states into the compact.

One of the principal functions of the compact is that of assembling and disseminating all types of information pertaining to the conservation and production of oil and gas and I.P.A.A. is without question the greatest single source of such information in the United States.

One of the biggest things I.P.A.A. can do in helping the compact accomplish its objectives and purposes is to furnish all available data, statistics and information concerning all phases of oil and gas conservation.

I.P.A.A. can aid the compact by continuing to give the commission the benefits of its considered advice and counsel, and by its continued wholehearted cooperation in compact activities.

The Interstate Oil Compact Committee

F. G. Stodder, Chairman, Wichita, Kansas

AS a result of the work of the Interstate Oil Compact Commission there now exists among the states a general feeling of free cooperation and a sincere desire to accomplish by all means possible the true conservation of oil and gas.

Through the activities of the compact, practically every geologist, engineer, physicist, and economist has found a vital interest in the commission's program. Actually, the first nationwide conservation program began with the organization of the commission.

The public as a rule has never taken a great interest in the conservation of oil or gas. To overcome this disinterest, the compact has made generally available much material, including a motion picture on oil. The accomplishment of the commission in developing a greater interest in proper promulgation of effective rules and regulations, as well as in public dissemination of information, is progress of a nature in which the commission takes justifiable pride.

The compact committee recommended that effort be made to include more states in the commission, that a larger personnel and larger budget be provided, and that emphasis be made to get all states to enact adequate oil and gas conservation laws. It was also recommended that the oil-producing states restrict production to actual consumptive demand.

It was suggested that if the United States Bureau of Mines discontinued making its prewar estimates of demand, this function be made a part of the activity of the commission. It was also suggested that an advisory committee similar in nature to the highly successful Petroleum Industry War Council be formed with independents predominating.

United States Supply And Demand

By H. B. FELL
Executive Vice President, I.P.A.A.

A PERMANENT, assured, and effective balance of supply with demand is fundamental to the conservation of our natural petroleum resources. The two elements of total demand are exports and domestic consumptive demand. The three sources of supply are domestic production, withdrawals from storage, and imports. To provide minimum aboveground waste, stocks should be kept at minimum working levels.

Fields should never be produced at rates in excess of maximum efficient rates of production. The maximum efficient domestic production would, therefore, be the sum of maximum efficient rates of all fields in the country. If consumptive demand is less than the maximum efficient rate then production should be restricted to consumptive demand to prevent waste. Nominations by purchasers do not indicate consumptive demand.

Imports of crude petroleum and its products should only be sufficient to make up any difference between total demand and domestic supply.

Cheap imports or excessive imports depress domestic crude-oil prices, result in increasing waste and make it more difficult to enforce conservation laws. Temporarily during the reconversion period there will be a drastic decline in demand which will necessitate a substantial restriction of production in order to rebalance supply with the new demand. As our civilian economy is gradually built up again demand will increase and by 1949 will probably reach the point where the demand will be as high as it was at at its peak last August.

Wartime Refining in Foreign Countries

By C. STRIBLING SNODGRASS

Associate director foreign division, PAW.

LEADING Germans attribute rightly their loss of the war to a large degree to the immense superiority of the Allies' oil supplies. German hydrocarbon fuel production reached a maximum in the winter of 1943-1944, was reduced to nearly zero by the summer of 1944 and was rebuilt in only small degree subsequently. Desperate efforts to rejuvenate German refining included underground plants and those concealed in small units in ravines, mountains, etc., which accounted for only small production.

Roughly 2 million barrels of crude refining capacity per day was available to and operated for the Allies, exclusive of the capacity in the U.S.A. and U.S.S.R. Added to the U.S.A. capacity this made at least 7 million barrels per day, plus Russia's plant output. This compares with Germany's bare 300,000 bbl. per day, plus upwards of half a million barrels captured in countries overrun by Germany, in France, and other Continental countries.

It required the mobilization of probably 200,000 to 300,000 men to rehabilitate that part of German plants which were rebuilt, not more than one-fifth of their total maximum capacity. This was soon destroyed by continued bombings. Figures show that the refining capacity in the Near East was operated during 1945, actual and programed, 177 per cent of the operations in 1939, while that in the Caribbean area operated at 148 per cent of its 1939 output. Had the war continued the Near East runs were scheduled to carry on at 194 per cent of their 1939 figures. Most of the foreign equipment installed came from the U.S.A., paid for not by lend-lease but by American dollars from the foreign companies.

The Petroleum Industry And the Army

By MAJ. GEN. W. E. R. COVELL

THE petroleum industry should have the satisfaction of a job extremely well done in supporting the armed forces' need for lubricating oils and fuels. The "know-how" of the industry, gained through experience and years of training permitted achieving the necessary goals. However, there exists problems the industry must face today or tomorrow in the light of war developments. These are described from the standpoint of personal experience in India, and some express the War Department's thinking.

The problems attendant reaching the producing goals required were many. New refining methods had to be arranged, new construction was carried swiftly out, materials were scarce—yet the industry produced 25 per cent more oil for the war than had been required in the peaceful years prior to 1941. The house that enabled this to be done had already been built. A winning team—Government and industry—did the impossible. Petroleum Administration for War was the necessary interlocking means of gaining this performance.

It must be pointed out that the Army and Navy must adjust their military equipment to operate on what products are available, in the quantities available, from industry. In this connection the development of the jet engine and gas turbine will create a large demand for fuel cuts in the kerosene and diesel-fuel ranges.

In looking into the future problems, an immediate one relates to the disposal and utilization of Government-owned petroleum facilities. In view of the great volumes of petroleum demanded in this war, our own resources must be examined. It has been calculated that the petroleum resources of the United States are about one-fifth or one-sixth those of the entire world. However, despite the fact that inestimable reserves remain to be located, discovery costs are increasing and fields discovered, on the average, show a trend toward being smaller in anticipatory ultimate recoveries.

In view of this, and the acknowledged fact that domestic reserves from our first line of defense, foreign oil should supply to some extent our peacetime needs as protection against the future. The activities of American Nationals should be continued in foreign fields. In this our nationals should compete on even terms with foreign operators.

Labor Relations

Wm. N. Bonner, Chairman, Houston

THIS report is in the nature of a challenge, limited to two problems. The first concerns the industry's suggested wage increase of 15 per cent and the effort of labor to obtain a 30 per cent increase. Judging these moves objectively, they can hardly be considered compatible with experience of the past few years. Wages have gone up during the war, drilling costs have increased 20 to 50 per cent, operating and material prices have gone skyward. Yet there has been only a very nominal advance in the price of crude. Now the producing industry is faced with decreased allowables, and further cuts are expected. This poses a problem for the independent producer that has no immediate solution.

Norman P. Hines, manager, Brazos River Gas Co., Mineral Wells, Tex.; Russell B. Brown, general counsel, I.P.A.A., Washington; James A. Upham, president, Brazos River Gas Co., Mt. Vernon, Ohio, and Ralph T. Zook, Bradford, Pa., retiring president, I.P.A.A.

Principles of National Oil and Gas Policy Adopted by I.P.A.A.

1. Domestic oil and gas producers should be encouraged to explore for and develop the oil and gas resources of the United States.

2. Only such imports of petroleum as may be necessary to supplement the domestically produced supply for domestic consumption and export should be permitted to enter the United States.

3. Regulation of oil and gas production should be carried out through adequate state conservation laws, effectively and equitably enforced by state regulatory bodies. Production must be in amounts which will not cause waste through excessive above-ground storage.

4. The industry must be alert to prevent the adoption of false theories of conservation, such as imports of a magnitude detrimental to the domestic industry, and thus endanger the progressive conservation program already established.

5. The price of crude oil within the United States should be such as to (a) encourage the exploration for and advancement of new flush production; (b) preserve wells of small production; (c) encourage secondary recovery operations; (d) discourage waste.

6. Research in relation to the development of synthetic fuels from coal and shale should not be neglected.

7. Oppose efforts of Federal Power Commission or any other federal agency to extend jurisdiction back of the point where interstate commerce actually begins. Jurisdiction over the end use of gas should not be conferred upon a federal bureau. The utility principle of regulation is not and cannot be adapted to gas producing and gathering business.

8. Government should establish and maintain a consistent foreign oil policy which will include vigorous adherence to the principle of "equal opportunity," and clearly exclude either direct or indirect participation by our Government in oil operations abroad.

Only if the price of crude is substantially increased can the independents fulfill their responsibilities in this move which, incidentally, they do not fundamentally criticize. They challenge all, the refiner, the marketer, labor, the buying public, and government agencies, to study this problem seriously. It must be solved.

The committee pointed out that the question of importing crude into this country should be of special concern to the American workman, for it is seen that for every 100,000 bbl. of crude brought in from foreign countries, 9,346 days of employment will be lost to the American workman.

The committee concluded its report by stating it was confident that in time the producers would secure a substantial increase in the price of crude, and that this would enable them to make even further wage adjustments and increases.

Drilling Contractors

Al Buchanan, Chairman
San Antonio

THE drilling contractor, who in many instances is also a producer, has a vital interest and a rightful place in the association.

Most producers have found it is not advisable to build their own drilling organization. It is better and less expensive to depend upon those organized in this specialized field.

The drilling contractors are not merely an adjunct to the producing industry. They recognize an obligation on their part to be vigilant in their search for more efficient and cost-saving ways of delivering their merchandise—which is simply hole in the ground. Future prospects for contractors depend entirely upon future prospects of the producing branch of the industry. If the period of readjustment in the immediate future is difficult for the producers, it will be equally difficult for the drilling branch. One trend can be foreseen. During the war rigs were working about 365 days a year; in the months to come, it is doubtful if a 60 per cent average working time can be maintained. This is bound to reduce some of the efficiencies made possible through continuous operation.

Oil and Gas Production Committee

B. A. Hardey, Chairman
Shreveport

THE committee called attention to the fact that association has for years encouraged a close balance of supply with demand to prevent waste, and stated that it is now as essential as ever that state regulatory bodies hold production to such a level that waste will not occur. In the past, purchasers have generally overestimated their demands, and in too many instances this has resulted in inequities in production. It was recommended that the most efficient rate of production of various areas be determined and that allowables be established accordingly.

The committee further recommended that Petroleum Administration for War continue to estimate demand for oil from each producing state and that when PAW discontinues its operations, the United States Bureau of Mines make available to the producing states estimates of the demand for crude, as was the practice in the years prior to the war.

In considering the problem of stripper wells in view of fixing production rates, it was held that no restrictions on production from such wells should be made that would be detrimental to the industry's continued effort toward conservation.

The committee recognized the threat inherent in import oil and recommended that the oil producers of the nation be given the opportunity to discover, develop, and make available the supplies of petroleum and products necessary before serious consideration is given furnishing the needs of the nation through imported crude.

Secondary Recovery

E. W. Hayes, Chairman
Independence, Kans.

A VERY substantial portion of the crude-oil reserves of the nation underlie what are commonly known as stripper wells. These reserves are variously estimated at from 3½ to 4½ billion barrels of which approximately 40 per cent is recoverable under producing methods now in use on the wells. The other 60 per cent can only be produced through the application of secondary-recovery methods, and only a small portion of this can be recovered under the present crude-oil price structure.

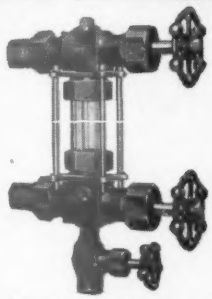
In order to recover the reserves underlying such wells and make their reserves available to the public and the nation for safety and well being, it is essential that there be a crude price high enough to justify continued operation. The committee believes this can be accomplished through a premium in excess of the present posted price for oil produced from stripper wells.

The committee further urged that a study be instituted, immediately, to arrive at a program which would provide an adequate premium price. It was pointed out that one threat to the nation's secondary-recovery operations existed in the proposals

PENBERTHY

"ALL IRON"

WATER GAGE SET



Extra heavy construction throughout. Body made from special high strength alloy iron, shanks alloy steel and trim stainless steel. Automatic and positive shut-off if glass breaks, valves self-cleaning, dripless drain cock permits gradual blowing off of gage. Conforms with A.P.I.-A.S.M.E. requirements.

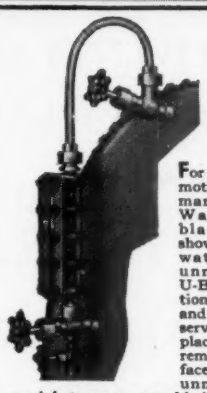
The Heavy Duty "All Iron" is one of the complete line of Penberthy gages that meets every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT 2, MICH. Canadian Plant WINDSOR, ONTARIO

PENBERTHY

"REFLEX"

WATER GAGE SET



For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

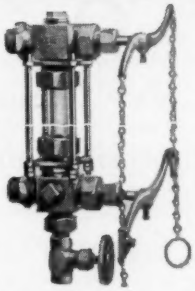
This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

PENBERTHY

"NAVY TYPE"

WATER GAGE SET



Extra heavy construction made of "Navy Bronze Composition M." Important features include: regrinding valves, automatic and positive shut-off if glass breaks, valves self cleaning, glass offset from stems to allow cleaning from either end without loosening packing. Conform with A.P.I.-A.S.M.E. requirements.

The "Navy Type" is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT 2, MICH. Canadian Plant WINDSOR, ONTARIO

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EJECTORS

Use the power of steam, air or water under pressure to lift liquids. Being simple jet pumps they have no moving parts and require no lubrication. A variety of models to meet different conditions. Also used as water heaters.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

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AUTOMATIC INJECTORS

The accepted method for assuring an uninterrupted supply of feed water to oil field boilers. Penberthy Automatic Injectors will supply feed water to boilers at minimum cost, are quickly and easily installed, reliable under most severe operating conditions, require little attention and no careful handling. Highest quality design and rugged construction.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

PENBERTHY

SUMP PUMPS

Used wherever seepage water accumulates, the Penberthy Automatic Electric Sump Pump and the Penberthy Automatic Drainer (water or steam operated) have demonstrated their superiority in this service. Simple and rugged design—copper and bronze construction throughout.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

ONE HUNDRED TWENTY-SIX UOP UNITS
were designed, constructed and placed in operation for production of war-time fuels.

Codimer	56	Isomerization	13
HF Alkylation	28	Cumene	11
Catalytic Cracking	13	Dehydrogenation	5

The technique and know-how developed during the war in the research, design, and operation of these units together with that accumulated for many years before the war are now available for the post-war period.

Universal Oil Products Co.
Chicago 4, Ill., U. S. A.

Petroleum Process Pioneers
For All Refiners

U. O. P. Service Protects Your Refinery

to import large volumes of petroleum. This proposal is serious and the public must be informed as to the fallacies of the suggestion.

Natural Gas and Distillate Production

By J. R. BUTLER
Cotton Valley Operators Committee

RECENT years have witnessed growing importance of gas-distillate production. Paralleling the increased utilization of distillate has been an expansion in the number of unitization programs for the development of gas-condensate-type reservoirs.

Some plan of unitization has been found most advantageous in the development of this type of reserve because it makes a constant pressure-maintenance program possible, and effects major savings by eliminating the drilling of unnecessary wells. Unitization also results in an increase in total fluid recovery due to the use of a unit gasoline plant and central plant operation.

Operating expenses for the field as a whole are effectively reduced through unit operation, improved arrangements are made practical by centralizing production and through the making of finished products, and on the unit basis it is possible to control area production without the necessity of maintaining offset operation. The latter factor extends the time of marginal operation. All of this results in the greatest amount of products with the least expenditure of effort, at minimum investment. Unit operation provides comparable per-acre recovery on the basis of investment in gas-distillate reservoirs as compared to oil fields and this is a stimulus for development of such properties.

The independent producer is interested in obtaining a well-regulated and well-managed unit in which he may participate fully and often finds this more to his advantage than turning his individual operation over to a single company.

Secondary Recovery Research

By DON T. ANDRUS
President, Pennsylvania Grade Crude Oil Association, Oil City, Pa.

INTEREST in research, with the view of increasing production from the type of wells producing throughout the Pennsylvania oil areas, was first expressed in the late 1920's.

From a small start by Bradford District Oil Producers Association at Penn State College, the research program was expanded to cover the whole of the Pennsylvania region. At present this type of research, covering many projects, is being carried on with a budget of approximately $100,000 a year. Results of the work are assembled and made available to producers through field engineers.

Since the Bradford field is the largest and longest conducted water flood operation in the world, it is interesting to note what has been accomplished in the area.

With present known methods there remain some 115,000,000 bbl. yet to be recovered. However, applying the methods we now use, we would leave some 700,000,000 bbl. of high-grade oil remaining in the ground at a normal depletion status. Our present research is being directed to lowering that huge figure so that we can produce with economic success a greater portion of that 700,000,000 bbl.

The same general picture applies to the United States as a whole for residual oil remains high in a majority of the producing areas abandoned or approaching normal depletion.

Proposed National Legislation Pertaining To Public Lands

Emery Carper, Artesia, N. M., and A. B. Cobb, Great Falls, Mont.

FOR some time a movement has been on foot either to revise completely the federal mineral leasing act or to liberalize the provisions thereof to overcome some of the objections. Proposed bills (S.B. 1,236 and H.B. 3,711) obviously are designed to cure some of these objections and are steps in the right direction.

Passage of these bills undoubtedly would encourage further exploration and development of public domain, but they do not remedy some very harsh and inequitable situations brought about by the provisions of the existing act. The proposed bills should be amended to grant to any lease owner the absolute right to renew leases for a term of 10 years and so long thereafter as oil or gas is produced in paying quantities, and to give the absolute right to all owners of old leases issued under the permit system to exchange them for the new form of lease regardless of the date when issued and regardless of the reduction of royalty to the United States. Regulations dictating to lease owners the manner in which they should handle or dispose of their working interest and limiting the amount of overriding royalties and obligations payable out of production created by lease owners should be forbidden.

Tax Policy and Advisory Committee

Tom Marshall, Chairman
Oklahoma City

WITH the entry of the industry into the reconversion period, certain tax problems require earnest consideration. One of these has to do with any operator who is likely to be a party to an agreement covering the operation of a repressuring or recycling project. It would be well for such an operator carefully to consider the probability of the contract being construed as subject to taxation as a corporation. It is also noted that analysis must be made of the closing of contract in case of a sale of properties where it is desired to tax the resulting profits as capital gains.

The committee reminded the oil men of the adverse impact of the F.H.E. Oil Co. case. The report called attention to the cooperation of industry operators in gaining correction of this adverse decision.

The committee stated it believed that during the coming session of Congress, when a new revenue bill will be considered, the industry should endeavor to have the salient features of Concurrent Resolution 50, which corrected the F.H.E. decision, made a part of the Internal Revenue Code. It was also recommended that Congress fix social-security-tax rates at their present level.

The Long and Short Term Demand for Oil

By J. V. BROWN
Petroleum Analyst, I.P.A.A.

TOTAL petroleum requirements from the United States to meet civilian, miltary, and export requirements in the last quarter of this year is estimated at approximately 5,000,000 bbl. daily declining through the first 3 quarters of 1946 to 4,700,000 bbl. daily. Indicated crude requirements for the remainder of the year will be about 4,400,000 bbl. daily, dropping off to 4,000,000 bbl. a day through 1946. Some stock rebuilding may retard this decline.

Petroleum inventories fell 100,000,000 bbl. during wartime. Civilian gasoline demand is below the prewar level due to 2,500,000 fewer passenger cars being in use. Kerosene and fuel oil requirements are already in excess of prewar totals. The demand trend will be upward beginning in late 1946 and will ascend through 1947 to 1950 reaching the 1945 wartime peaks in 1950.

After temporary setbacks, the world petroleum consumption trend will again turn upward.

A.I.M.E. Concludes Series of Mid-Continent Meetings

by Charles J. Deegan

The Petroleum Division of the A.I.M.E. held regional meetings in Tulsa, October 8, Fort Worth October 12 and 13, and Houston October 15. An account of the Tulsa meeting, and abstracts of technical papers, appeared in last week's Journal. The accompanying article reports on the two meetings in Texas. Abstracts of technical papers presented at the later meetings appear on pages 159-160 of this issue.

FOLLOWING up its first meeting in Tulsa, with sessions in Houston and Fort Worth, the American Institute of Mining and Metallurgical Engineers concluded its Mid-Continent program of regional meetings, and prepared to move on to Los Angeles for the Pacific Coast regional meeting on Friday, October 19. The Houston and Fort Worth meetings attracted attendance of nearly 200 engineers at each, making the grand total for the Mid-Continent almost 600.

Both the Houston and Fort Worth meetings were characterized by the balance in the type of material covered in the papers. Some covered items of immediate importance in practical applications; some were progress reports on subjects intermediate between practical application and basic research, while others were reports on pure research projects.

One of the most interesting papers was presented at Houston by M. A. Westerbrook and J. F. Redmond, Shell Oil Co., Inc., which gave the engineers a new technique by which formation porosities could be obtained directly from drill cuttings, eliminating the necessity of coring. In view of the contrasting problems of reducing drilling and completion costs while more and more data on reservoir conditions is an engineering must, this hope of reconciling the two objectives received much attention.

The ever-increasing importance of mud problems was recognized and well served by two papers at Houston, one of which was repeated at Fort Worth. These were "Late Developments in Mud-Analysis Logging," by Ott Pixler, Baroid Sales Division, Houston, and "Effect of Arsenates on the Viscosity of Drilling Muds," by B. C. Craft and C. M. Moncrief, Louisiana State University.

With bottom-hole-pressure measurements constantly entering into all reservoir-engineering problems, while steadily increasing depths bring higher and higher pressures, E. R. Brownscombe and D. R. Conlon, Atlantic Refining Co., Dallas, in their paper, "Precision in Bottom-Hole Pressure Measurement," drew many questions from the audience, both in Houston and Fort Worth. They described improvements in the measurement of bottom-hole pressures which permit measurements as high as 5,000 psi., within a gage error of 2 psi.

The problems faced by engineers in dealing with efficient operation of the increasingly frequent condensate fields where cycling principles are used were emphasized by developments of certain theoretical concepts brought out in "Performance of Distillate Reservoirs in Gas Cycling," by W. Hurst and A. F. Van Everdingen, Shell Oil, Houston. From their studies it is apparent that the efficiency of recycling is profoundly influenced when differences in permability are taken into consideration. This paper was presented both at Houston and Fort Worth.

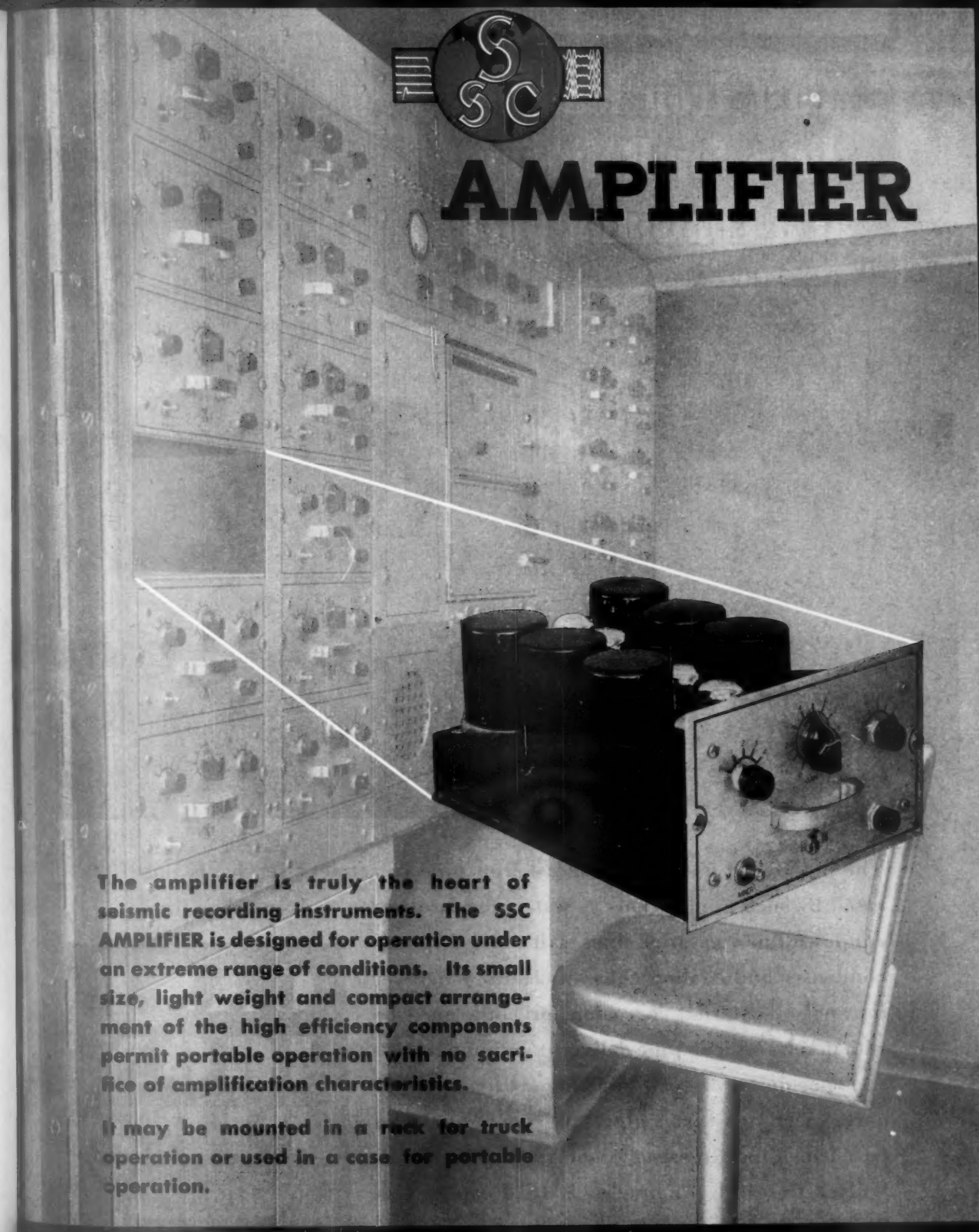
The potential savings of $1,200 per well resulting from reduction in unnecessarily long-time periods established by regulation as necessary in waiting on cement to set attracted as much attention in Houston as it had previously in Tulsa. This information was developed in the paper on "Method for Determining Minimum Waiting on Cement Time," by R. Floyd Harris, Stanolind Oil & Gas Co., Tulsa.

At Fort Worth, the many engineers with hydrogen-sulfide corrosion problems, particularly in West Texas, were eagerly awaiting the report on "Formaldehyde as an Inhibitor of Corrosion Caused by Hydrogen Sulfide," by P. L. Menaul and T. H. Dunn, Stanolind Oil & Gas Co., Tulsa. As was the case in Tulsa, when it was first presented, this paper pointing out the immediate solution of a serious operating problem, brought out many questions and aroused the greatest interest.

During the programs at both meetings, M. L. Haider, chairman, petroleum division, A.I.M.E., New York, continued his policy of bringing explanation and discussion of the division's problems direct to the membership. Following the Fort Worth technical session, an open meeting was held by the general committee of the petroleum division, at which a heavy agenda was discussed.

The following major topics were

Right: Morton T. Higgs, chairman, and W. E. Hubbard, vice chairman, Gulf Coast section, A.I.M.E., snapped at the Houston meeting. Below: W. S. Morris, executive committee, petroleum division, A.I.M.E.; Charles H. Pishny, chairman, North Texas section, A.I.M.E.; Harvey S. Mudd, president and director, A.I.M.E., and M. L. Haider, chairman, petroleum division, A.I.M.E., snapped at the Fort Worth meeting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AMPLIFIER
The amplifier is truly the heart of seismic recording instruments. The SSC AMPLIFIER is designed for operation under an extreme range of conditions. Its small size, light weight and compact arrangement of the high efficiency components permit portable operation with no sacrifice of amplification characteristics.
It may be mounted in a rack for truck operation or used in a case for portable operation.
Seismograph Service Corporation
TULSA, OKLAHOMA, U. S. A.

Cast Iron loading lines for Refinery at a Louisiana port

The all-around usefulness of cast iron pipe in refinery service is indicated by such applications as water, fire protection and sewerage lines, rundown lines, gasoline lines, salt water disposal, condenser and cooling coils, et cetera. Wherever internal or external corrosion, or both, must be withstood, cast iron pipe delivers maximum resistance per dollar of cost. For longer life and economy, specify cast iron pipe. Address inquiries to Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago 3, Illinois.

CAST IRON PIPE

For Longer Life and Economy

on the official agenda. Reports of standing committees; progress report on employment of an executive secretary; review of policy and plans for petroleum news section in Mining and Metallurgy; reorganization of the petroleum division; consideration of additional standing committees on labor relations, local section activities, and distinguished lecture tours; election of chairman of standing committees for a 2-year term; revision in procedure of nominating committee; preparation of petroleum division "Operating Manual"; assessment of annual dues for division membership; consideration of action on reports of special A.I.M.E. committees on "Divisional Relationships," and "Ways and Means"; and 1946 divisional meetings.

The Houston meeting was handled by the following: Morton T. Higgs, chairman; W. E. Hubbard. Harold Vance, and H. H. Power, vice chairmen; Alexander Deussen, secretary-treasurer, and as heads of special committees, W. E. Hubbard, Warren L. Baker, George L. Nye, and A. W. Waddill.

The Fort Worth meeting was handled by the newly organized North Texas section, Charles H. Pishny, chairman; K. Bruce Davidson, Gordon H. Fisher, and Brad Mills, vice chairmen; Richard T. Bright, secretary-treasurer, and serving on special committees, M. H. Dubrow, Perry Bass, Malvin Handy, Lynn K. Lee, L. F. Peterson, Peter P. Gregory, Don L. Harlan, Rex Rader, Gordon Fisher, and Leroy Menzing.

Disposition of War Emergency Lines Now Up to Congress

WASHINGTON. — Ultimate disposition of the big-inch and little big-inch pipe lines is now up to Congress, since administrative agencies have completed arrangements to close operations of these war-emergency lines, drain them of oil, and advertise them for sale as surplus government property.

Hearings on the subject will commence shortly before the Senate petroleum resources committee, Chairman Joseph C. O'Mahoney announced in issuing a committee report summarizing views presented to the committee in correspondence. Although the hearings will also cover policies regarding disposal of tankers, refineries, and other government-owned property in the oil industry, chief attention is expected to be given these two pipe lines.

The proposal made by Petroleum Administration for War that the oil in the big-inch pipe line be expelled by pumping in water has been accepted by Surplus Property Administration, in view of the fact that oil now in the line has been sold for immediate delivery, and that no contracts have been made for oil to be delivered to the line after October 15.

A letter from SPA to Ralph K. Davies, deputy petroleum administrator, says that it had been hoped to dispose of the pipe line while it was still in operation, but that in view of the circumstances, SPA had no alternative but to acquiesce to PAW's suggestion.

"You will understand, of course," the letter adds, "that such acquiescence is not intended as reflecting any opinion on what action should be taken in the light of possible shortages of oil on the East Coast in the immediate future, a matter which is completely outside the jurisdiction of this administration."

The Government's other major war-emergency pipe line, the little big-inch, was shut down September 15, and displacement of the petroleum fill with water treated with sodium hydroxide (to minimize corrosion) was started September 30.

It was pointed out that the various government petroleum pipe lines now owned by Reconstruction Finance Corp. have not yet been declared surplus, and thus are not yet under the jurisdiction of SPA.

The big-inch runs from Longview, Tex., some 1,250 miles to New York Harbor. It had transported 260,750,000 bbl. of crude oil up to August 31. The little big-inch runs 1,475 miles from Beaumont, Tex., to New York. Up to August 31 it had transported 156,000,000 bbl. of petroleum products.

No Offers to RFC

RFC has received no offers for the lines. Under the provisions of the surplus property law all offers to purchase must be submitted to Congress for approval.

Sen. William Langer, of North Dakota, has introduced a resolution to declare it the sense of Congress that the WEP lines should not be disposed of as surplus property but should be retained and operated by the Government.

The O'Mahoney report summarized the diverse proposals for disposing of the pipe lines, such as their operation as common carriers or their conversion to natural gas, but stated no conclusions. Most of the report was given over to reasons why the lines were drained, which perhaps indicates that the committee does not disapprove of this action.

Oil Compact Commission To Meet in December

OKLAHOMA CITY.—A meeting of Interstate Oil Compact Commission will be held in Wichita, Kans., December 13-15, it was announced at the organization's headquarters here.

"The commission," Gov. Andrew F. Schoeppel, of Kansas, chairman, said, "voted at its last meeting in 1944 to cut the number of its 1945 meetings in half in view of travel and hotel conditions, and the coming meeting will be only the second held by the commission this year. We hope that by next year conditions will permit the return of our regular quarterly meetings."

Earl Foster, commission secretary, said that the 3-day program would be devoted to problems facing the petroleum industry in the postwar period and a projection of the commission's inquiry into the natural-gas situation.

Senate Action on Oil Treaty Expected Soon

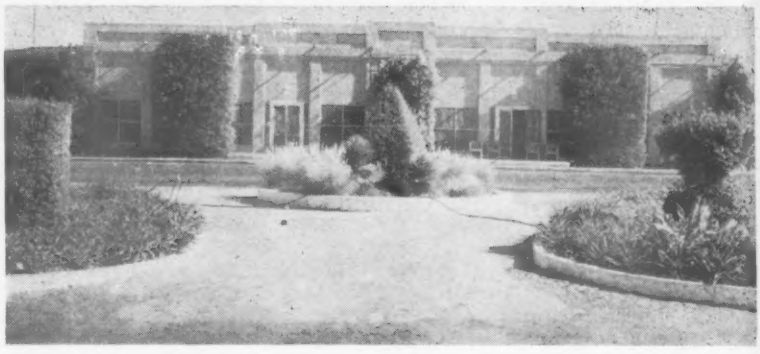
WASHINGTON. — The new Anglo-American petroleum agreement is expected to be submitted to the Senate for ratification very shortly. Secretary of the Interior Harold L. Ickes, who has just returned from the signing in London, planned to discuss the treaty with President Truman this week. He said he did not anticipate much opposition to ratification.

Secretary Ickes described the treaty as a very satisfactory agreement from the standpoint of our national interests and our petroleum interests, and said he was much pleased with the attitude of the British officials who participated in the negotiations. Our nationals can now proceed to develop their foreign properties with confidence and can dispose of their oil in "a real competitive market," he said. The agreement protects existing American interests in the Middle East and will result in the removal of various kinds of restrictions which have made it difficult to operate, such as the so-called "red line" agreement, the secretary stated, explaining that such specific matters as construction of a pipe line across Saudi Arabia would be taken up by the international committee which is to be formed after the treaty is ratified.

Other nations will not be formally invited to sign the oil treaty until it has been ratified by the United States and Britain, Ickes said.

XUM

MIDDLE EAST REPORT *from the* EDITOR



View of Bapco Club building, provided for employes of the Bahrein company

by C. O. Willson

Bahrein Island Produces 20,000 Bbl. And Refines 70,000 Bbl. Per Day

BAHREIN ISLANDS, Persian Gulf. On this island which is 30 miles long and 10 miles wide, and the largest of the Bahrein group, a petroleum operation was able to reach its goal of supplying a maximum output of war products. It became one of the two main sources of war supply in the Eastern Hemisphere and the bulk of its products directly supported the Allied offensives against Japan.

Briefly described, this operation of Bahrein Petroleum Co., Ltd., consists of a controlled field production of 20,000 bbl. daily and a refinery which processes 70,000 bbl. daily of crude oil. The 50,000-bbl. difference between the field and refinery capacity is supplied by Arabian American Oil Co. from its fields on the adjoining mainland of Saudi Arabia to which it is connected with a submarine pipe line.

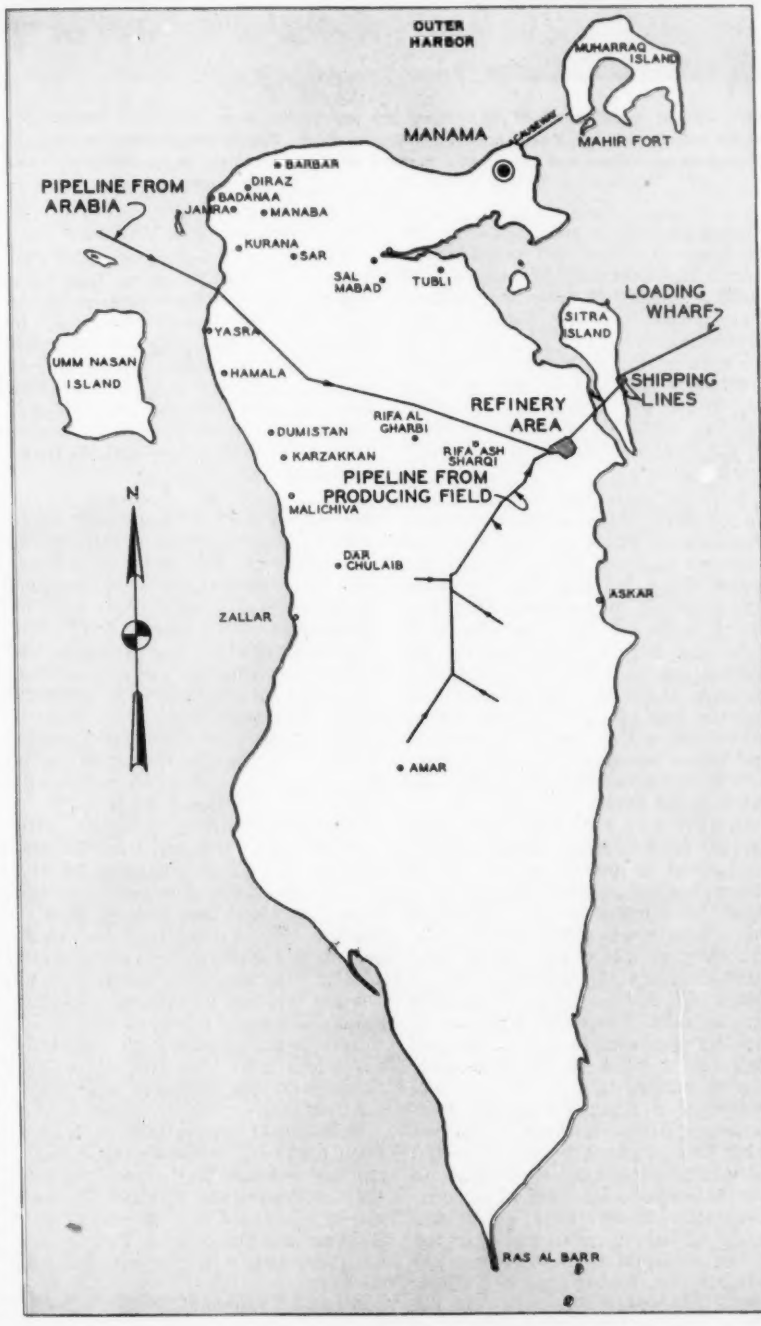
The program of more than doubling the crude-oil capacity of the refinery including facilities for the largest possible output of 100-octane gasoline was started in the early part of 1944. Bechtel-McCone, of San Francisco, was engaged to design a substantial portion of the new equipment as well as to construct the entire new additions. A construction force of 750 Americans and 4,000 Bahreinis were engaged for a period of 18 months to carry out the construction. Universal Oil Products Co. of Chicago designed the fluid type catalytic cracker and reformer. Chemical Construction designed the acid manufacturing and acid recovery plants. All processing units of the new construction are now on stream and when additional steam and power output, shops, and other supporting facilities are completed this section of the petroleum world will have as well balanced a refinery operation as will be found anywhere.

The entire oil development is less than 15 years old. The discovery well was completed in 1932 by the company which is incorporated under the laws of Canada and which at that time was wholly owned by Standard Oil Co. of California.

In a short time it was known that a major field had been discovered. California Standard had no marketing facilities in this area and in 1936 a merger with The Texas Co. was consummated and that company became a 50 per cent owner of the Bahrein company. The merger resulted in the company, through its marketing subsidiary, Caltex Co., becoming an active distributor of petroleum products over a wide area. This territory can be conveniently served by the Bahrein re-

Main office building of Bahrein Petroleum Co., Ltd., at Awali, where field and refinery headquarters are located

Above: View of Awali camp from the water tank looking toward Rafa Hill. Right: Map of Bahrein Islands, showing oil-operating features and other points of interest



finery through shipments by tanker.

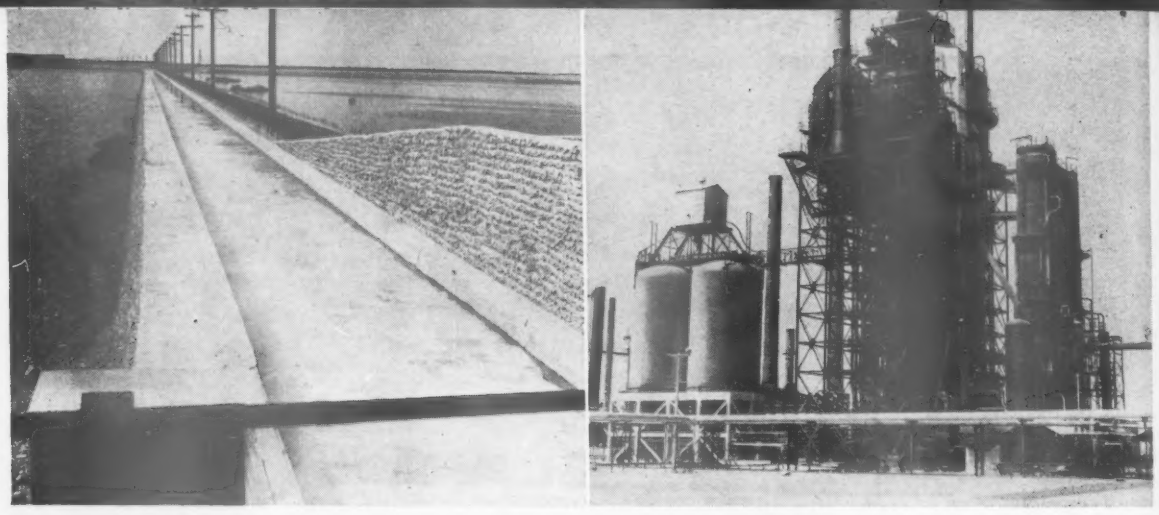
Steady development of the field, resulting in the completion of 74 wells with no dry holes, has outlined the structure which is located in the approximate center of the island. The field is 7½ miles long and 2½ miles wide and consists of approximately 16,000 acres. The first 10 wells were drilled with cable tools but difficulties experienced with pressures brought the use of rotary tools in drilling in. Since 1936 all drilling has been with rotary equipment.

The geology of the island is simple and the structure of the field is apparent from the surface outcroppings, being a simple fold with the major axis lying in a north-south direction and with dips ranging from 3½° to 6°. There is no evidence of faulting. Hard durable limestone strata near the surface have been eroded away in the crest of the field, leaving a rim-rock surrounding the entire field. The surface of the island from the rim-rock outward in all directions is approximately a dip-slope. Mapping of strata exposed in outcroppings along the rim-rock and from exposure of these strata in water wells and washes parallels very closely the subsurface structure.

Three Pays

Oil production is secured from three pays known as the first pay, second pay and fourth pay with the second pay divided into two zones for producing purposes. The third pay is not of commercial value. The largest portion of the oil production comes from the first and second pays while the fourth pay yields the remainder of the oil together with high-pressure gas produced only for gas injection into the upper pays. The method of drilling and operating the wells which includes several features of special interest will be described in a second article.

The total thickness of all the pro-



Left: Cooling requirements of the refinery are met in two ways. In closed systems fresh water from wells is used. The remainder of the refinery cooling is accomplished with sea water. This is brought to the plant via a canal from the gulf and picked up by high-pressure pumps and discharged through underground lines to the operating units. This is a picture of the canal. Right: Catalytic cracking unit

ducing sections is approximately 500 ft. with the first and second pays occurring between the depths of 1,800 and 2,200 ft. from the surface. The initial reservoir pressure was approximately 1,200 psi. The oil is undersaturated with gas at reservoir conditions and the bubble point is 250 to 350 psi. There was no initial gas cap and the producing horizon in general operates under an active water drive.

Several years ago it was determined that, at the optimum production rate of 20,000 bbl. per day, the pressure declined showing that the water drive did not keep up with the crude-oil withdrawal. This was offset with gas injection. An artificial gas cap was created by injecting gas in the main producing horizons of the first and second pays and the rate of gas injection is now controlled to balance oil withdrawal and water invasion so that the pressure is maintained at approximately the original levels.

In 1937 and 1938 six wells were drilled to a deeper horizon. This production is known as the fourth pay and is composed of a number of thick limestone members. Several of these members contain dry gas only and others contain oil and gas but are generally characterized by a thin band of black oil and a large gas-cap area. The depth pressure of the dry gas members is 2,100 psi. This gas is used for the gas-injection operations to the first and second pays without the aid of compressors. Approximately 4 million cubic feet of gas is being reinjected daily. The producing wells flow to five tank batteries located at central points in the field where the crude oil is degassed and pumped to the refinery. The separated gas is used for fuel purposes in the Awali gas-supply system.

Housing and Utilities

As soon as it was determined that a large crude-oil reserve had been discovered the management made plans for permanent operation. In carrying out this program the company has pioneered in practices which have been adopted by other operators and which through the years will add to the attractiveness of development in this area to managements and employes.

Previous to the discovery of oil the activities of nationals on these islands were largely confined to pearling, the production of dates, and small shipping and trading operations. The islands constitute an independent sheikhdom ruled by His Highness Sheikh Sir Sulman bin Hamed al Khalifah who has taken an active interest in the oil activity from its beginnings. The British Government has certain treaty rights with Bahrein Islands as it has with other independent sheikhdoms of the Persian Gulf.

The islands are now served with the sea and land airplanes of the British and land airplanes of the Army Transport Command of the United States. The land airport is located on the island of Muharraq which is connected by a causeway to Manama, the principal town and seaport of the islands. Except for small sections the islands consist of desert country with high temperatures and high humidity prevailing throughout the summer and early fall months.

Substantial investments have been made by the company in furnishing housing and other facilities for the Americans and British who are in charge of operations and the Bahrein nationals who are playing an increasingly important part in the operations.

Awali, the field and refinery headquarters and the principal camp, was built "from scratch" by the company. It is located on an elevation 18 miles south of Manama to which it is connected by an improved highway which was built by the company. The camp is 3 miles from the refinery.

The housing consists of 140 homes for married members of the staff with 20 additional houses under construction at this time. In addition to the office building there are several bachelor quarters, a club, restaurant, laundry, ice plant, and most of the other facilities found in a modern town located in the United States or Europe.

A feature of special importance in isolated operations of this type is the extensive use of air conditioning. Awali is said to represent the largest installation of its kind. All homes and other living quarters and most of the buildings of the camp are connected to three central air-conditioning plants. At these central plants water is chilled to a temperature of 45°-50° F. and then circulated through a system of underground pipe lines to each of the houses and buildings. The buildings are kept at comfortable temperatures controlled by means of water circulation through grills. During the winter months the small amount of heating required is furnished by circulating hot water through these same systems.

It is emphasized that the use of air conditioning does not represent an effort on the part of the management to supply what would be considered luxury living conditions in temperate areas. This program has proven its value in many ways from the standpoint of personnel morale and reduced sickness.

Certain savings in construction also tend to offset in part the in-

creased investments. Before the advent of air conditioning houses were constructed with high ceilings, large porches, and other features designed to secure the maximum natural cooling during the summer months. With air conditioning the housing consists of smaller compact structures with the same living space as the larger buildings.

It should be pointed out that over a 5-year period this area operated under war conditions. All operations were carried on for 2½ years under a complete blackout. The refinery was bombed in 1940 by the Italian air force with only small damage resulting. Since the close of the European war the wives of many British and American employes who left here in the early part of the war have returned and housing provisions are to be made for all permanent employes.

Refinery

The principal operating equipment of the refinery consists of:

Two low-pressure atmospheric tower crude-oil distillation plants.

One low-pressure atmospheric and vacuum tower crude-oil distillation unit.

One fluid-type catalytic cracking plant.

Two thermal reforming units.

Two thermal cracking units.

One thermal gas-recovery plant.

One fluid-type isomerization plant.

Sulfuric-acid-type alkylation plant.

Sulfuric-acid manufacturing plants.

Acid-recovery and concentration plant.

Three acid-treating plants.

SO_2 treating plants for kerosene.

PbS sweetening plants for gasoline.

Kerosene sweetening plant.

Two steam and power plants.

Salt and fresh-water pumping systems.

Mechanical shops for construction and repair.

Drum manufacturing and filling plant.

Bulk loading terminal.

A visit to the refinery emphasizes the fact that petroleum refining in this area must of necessity be more than a processing operation. In normal times it takes three weeks, and during the war period it took months to obtain delivery of construction and operating materials and equipment. To cope with this situation long-range planning is necessary with greater stress placed on the standardization of equipment and materials and the use of shops for the manufacture and maintenance of equipment.

Previous to the installation of units for the production of 100-octane gasoline the refinery was operated for several years as a 34,000-bbl. refinery in a balanced crude-oil distillation, thermal cracking, and reforming operation. Due to the strategic location of the refinery from the standpoint of war petroleum supplies and the availability of additional crude-oil from Saudi Arabia, American-British petroleum boards approved an enlargement program in 1943 which approximately doubled the crude-oil capacity of the refinery. Catalytic cracking, alkylation, and isomerization units were added to assure the maximum production of 100-octane gasoline and at the same time maintain the needed production of other products. The plant output now consists of: 100-octane gasoline; 67 to 80-octane motor fuels; illuminating kerosene; power kerosenes; diesel oils, and fuel oils.

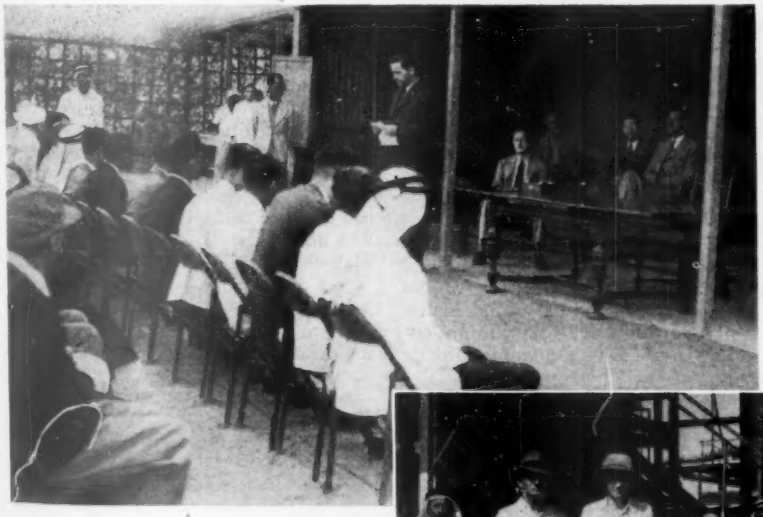
Crude Distillation

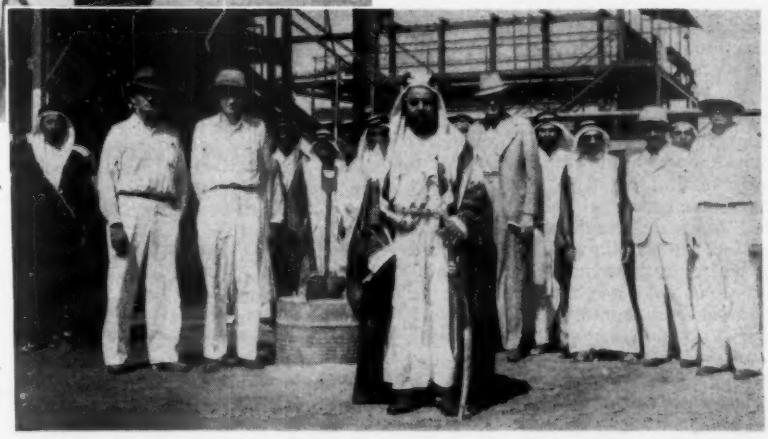
The Bahrein and Arabian crude oils are usually batched in the refinery operations. Typical inspections of the crude oils follow:

	Bahrein	Arabian
Gravity (°A.P.I.)	33.2°	34.7°
Sulfur (wt. %)	2.21%	1.75%
Viscosity (S.S.U./100° F.)	58.5	42.7
Pour point (°F.)	+20	+10
S & W (Vol. %)	0.1%	Trace to 0.1%
437° E. P. Gasoline—		
Yield (%)	37.4	37.2
Octane-C.F.R.-M.M.	40	37
Residuum after 437° E.P.—		
Yield (%)	62%	62%
Gravity (°A.P.I.)	20.0°	24.9°
U.S.B.M. Classification (Lane & Gorton)	Intermediate base crude	Paraffin-Intermediate base crude

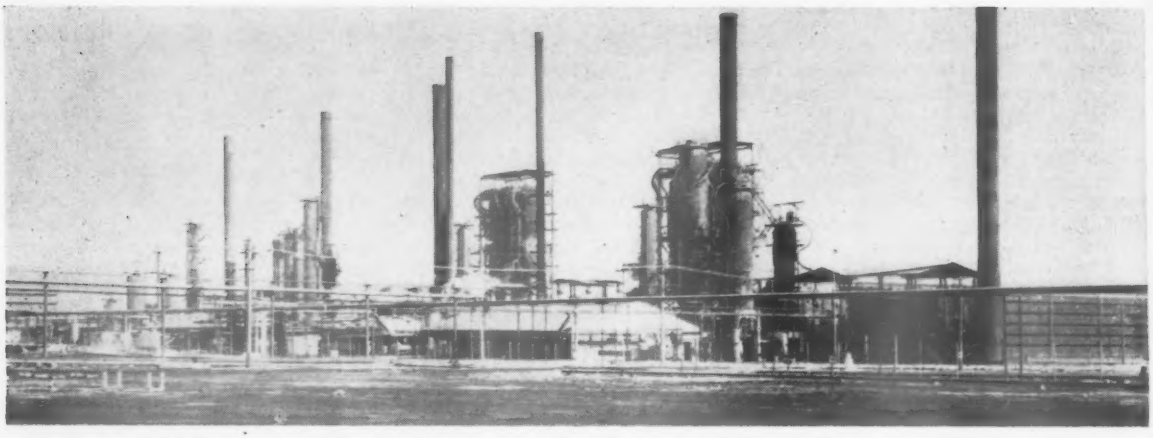
The original crude-oil distillation equipment consists of two 17,000-bbl. units each incorporating one heater and one main column. The cuts from these units are light and heavy gasoline, kerosene, diesel oil, and residual fuel oils. The final gasoline fractionating is obtained in a rerun column operated with a reboiler connected to the base of the main column.

The new 36,000-bbl. crude-oil distillation unit is operated in the same manner as the smaller units except that the large unit includes a vacuum tower from which is obtained an intermediate gas-oil cut and a heavy gas-oil cut. These cuts are used as charging stock for the catalytic cracking operation. This





Left: First 10-year-service-pin presentation to national employes. Below: Visit to Bapco refinery by His Highness Sheikh Sir Sulman bin Hamed al Khalifah, K.C.I.E.



Thermal reformer and cracking area

large unit includes the latest features in design for this type of operation. A control feature with which satisfactory results have been obtained is an electronic-type temperature instrument used in connection with the automatic fireman.

The light gasoline from these operations is used in the blending of finished gasolines. The heavy gasoline or naphtha stream is the charging stock for the reforming operation. The kerosene is treated in the SO_2 plant. The residual fuel is marketed as fuel oil and is also used as charging stock for the thermal cracking operations.

A gasoline recovery plant is operated adjoining the crude-oil distillation units. Propane and lighter hydrocarbons go to plant fuel, the butane and some isopentane are utilized in the aviation operation and heavier fractions are used in blending operations.

Cracking Operations

Thermal reforming consists of two 7,000-bbl. units which are operated at 850 lb. pressure and a temperature of 1,040° F. The butane and lighter hydrocarbons are removed from the finished gasoline in a stabilization operation. Each unit consists of a high-pressure pipe still, a fractionating tower, and miscellaneous auxiliary equipment.

The two thermal crackers are equipped for either a residuum or a nonresidual operation. The charging stocks consist of 16° to 19° A.P.I. gravity fuel oil. The units embody light and heavy oil coil heaters. The tar residue is removed from the system as salable fuel or reduced to coke by passing through heaters and coking chambers for the nonresiduum operation.

The pressure distillate from this operation is stabilized acid-treated rerun, and sweetened and constitutes part of the motor gasoline blending material.

Catalytic Cracking

The fluid catalytic cracking unit of U.O.P. design operates with a wide cut of gas-oil charging stock. The general design of the unit is the same as those installed at several refineries in the United States and which have been described in previous articles appearing in The Oil and Gas Journal. It is the two-stage type. The principal product is highly aromatic material which is used as base stock in blending high-octane aviation gasoline.

Other products include gas oil which is used for diesel oil and fuel oil and the important butane cut for the alkylation operation. The unit embodies steam generating equipment operating with waste heat to establish a heat balance. The major source of this steam is obtained directly or indirectly from the burning of carbon in the regeneration of the catalyst.

Isomerization and Alkylation

The isomerization unit is operated to produce isobutane from n-butane in sufficient quantities to supplement other sources of supply in the plant operation. The alkylation operation embodies the cold sulfuric acid process. These operations also incorporate the designs with which refiners have become familiar in connection with war operations.

Other Operations

The company is a manufacturer of some of the chemicals required in the plant operation. Its acid-manufacturing facilities employ standard equipment for burning pure sulfur and the plant has a capacity of 35 tons daily.

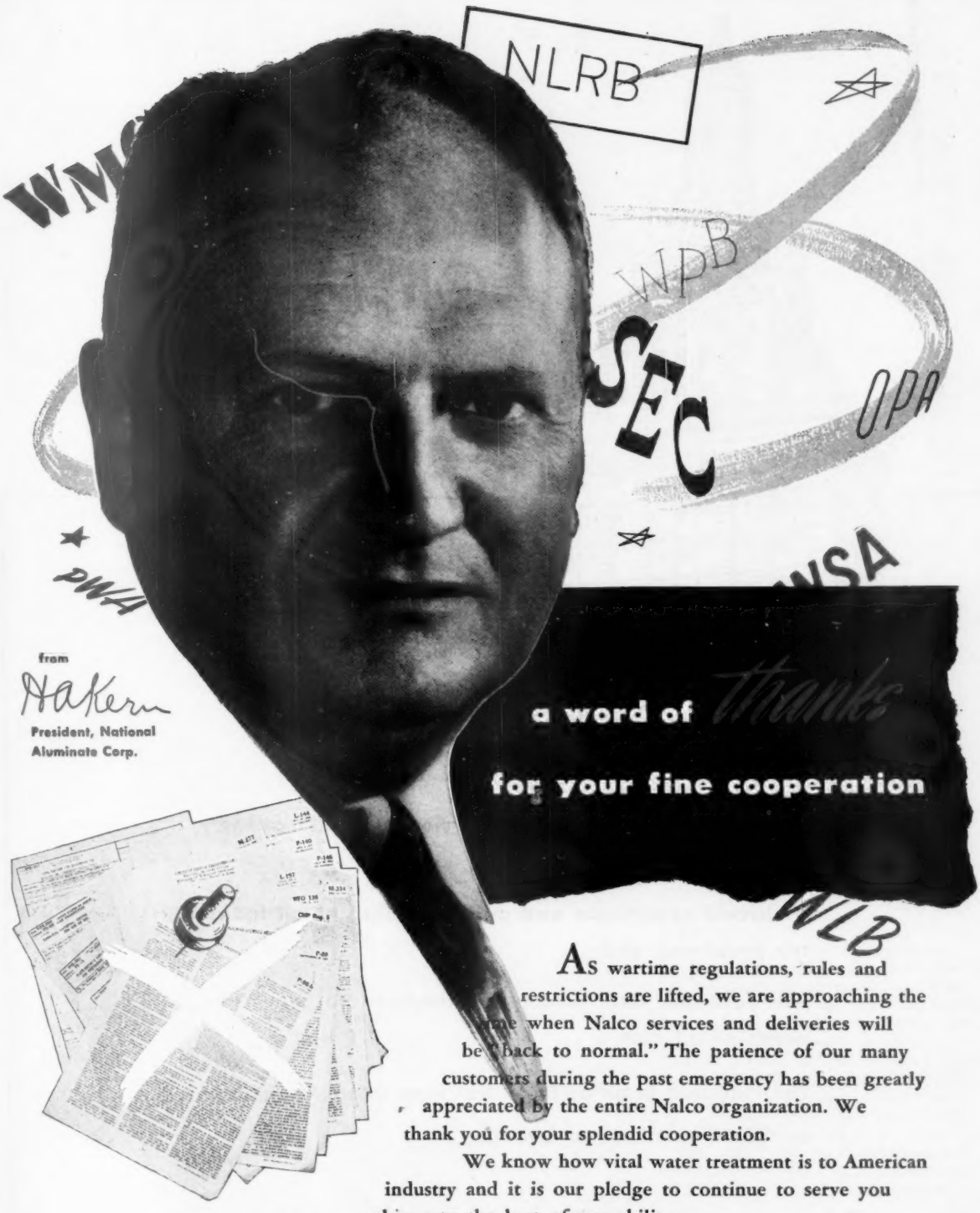
A large acid-recovery unit for the recovery of acid from the alkylation unit is now in operation. The company also manufactures hydrated lime from local limerock. This operation is unique in that it is carried on 100 per cent by Bahrein nationals.

The refinery not only supplies steam and electric power for the refinery but all the power for Awali and all shipping operations. When the additional capacity of the second plant is completed the steam plants will have a combined capacity of 430,000 lb. hourly of 550-lb. steam for processing and power uses. The generating capacity will be 14,000 kw.

All drinking water in the refinery and for use in the camp is distilled. The cooling requirements of the refinery are met in two ways. In closed systems fresh water from wells is used. The remainder of the refinery cooling is accomplished with sea water. This is brought to the plant via a large canal from the gulf and picked up by high-pressure pumps and discharged through underground lines to the operating units. A point of particular interest is that all underground lines for the sea water were manufactured at the plant of reinforced concrete pipe. The lines are 21, 30, and 48 in. in diameter.

The plant shops, now being enlarged, are to be completely equipped with modern shop tools including annealing furnaces. The company operates a steel-drum manufacturing plant with a capacity of 50,000 drums monthly. These drums are used in shipping products from the plant.

The principal construction under way at this time will provide additional loading facilities. A causeway and wharf are being built which, added to present capacity, will enable the principal products of the refinery to be loaded in tankers at the rate of 5,000 bbl. hourly, including several products simultaneously. The required depth for tankers is 3 miles from the shore. The new wharf will facilitate the unloading of supplies which in the past have required tedious lightering operations through several miles of shallow water navigable only at high tide.



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MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

A.A.P.G. to Make Widespread Survey of Research Facilities

by Charles J. Deegan

RECOGNIZING the worldwide trend toward organization and teamwork in research, and basing its scope on the principle that war has compressed the normal time scale by which scientific progress should be measured, the American Association of Petroleum Geologists, through its research committee, will soon announce a plan for a survey of the entire field of research in petroleum geology and in other fields that have a bearing on the problems of petroleum geology.

The committee will make an inventory of all research projects now being carried on in its field; where and by whom; how they are financed; what facilities are being used; and what personnel is engaged. In addition the survey will determine what personnel and facilities can be found for additional work, and what financial resources are available for new projects in various subjects.

The size and importance of the task is indicated by the research committee's statement that there are hundreds of institutions in the United States which are engaged in scientific research. The survey, among other things, is designed to discover which institutions are doing work of interest to petroleum geologists; what they are doing; how they are financed; and what facilities and personnel they have which might be allocated to additional projects that the committee might recommend.

It is believed that the survey will reveal the existence of many trust and endowment funds, as well as other types of financial support. Some of these are for research projects in other general fields such as chemistry. However, they might be available for financing special projects within the general field, geochemistry for instance, which would fit in the A.A.P.G. program.

Of particular interest to petroleum engineers and production men generally, is the subcommittee on production engineering. This group will review those portions of research and research needs in petroleum engineering which overlap some phases of exploration research. It will advise other geological subcommittees of advances recently made and work now in progress in production engineering that are closely related to geology. The group will keep production engineers advised of those portions of the A.A.P.G. program which might be of direct interest, so that the engineers will have opportunities to suggest useful additions or modifications.

The production engineering subcommittee will probably find much liaison work advisable between petroleum engineers and another geological subcommittee, that on reservoir fluids. The reservoir-fluids group will divide its field into two parts. One will be the observed relationships, stratigraphic and structural; physical and chemical; and the interrelationships of these four. The second part will cover theoretical and experimental work on origin; migration and accumulation; diageneseis; and regional reservoir behavior. Many of these problems are equally interesting to petroleum engineers and production men.

Project Areas Subcommittee

A subcommittee on project areas will furnish geographic background for information for locating and grouping recommended projects. By analyzing the features of the major regions of the United States which recommend them as natural laboratories for certain types of geological research, this group will work to reduce overemphasis on one region that might develop as a result of temporary causes.

Another group on discovery thinking will cut across the special-subject committees' work and analyze their planning and selection of methods. The task of the discovery-thinking group will be to produce an objective background which will permit the value and relative urgency of the various special research projects to be compared with the over-all program.

The subcommittee on geophysics and geochemistry will place particular emphasis on those phases pertaining to present application, and to ideas which give promise of developing new or improved instruments or techniques to apply directly in exploration for oil fields.

Two other subcommittees, one on stratigraphy and sedimentation, the other on tectonics, will have very large fields to survey. They will find other industries and other scientific organizations carrying on a vast amount of work, portions of which will have applications in petroleum-geology research.

The American Association of Petroleum Geologists, with over 4,000 members, is the largest, and one of the oldest and best organized professional societies in the petroleum industry. In the past it has sponsored many individual research projects, and has published several symposiums, notably "Problems of Petroleum Geology," "Structure of Typical American Oil Fields," "Geology of Natural Gas," "Stratigraphic-Type Oil Fields," "Possible Future Oil Provinces of the United States and Canada," and others.

Ambitious Program

The present research survey is, however, by far the most ambitious project of this type that the association has ever undertaken. It is understood that both the research committee and the executive committee feel that the need for such a large scale project is imperative and timely. Congress will soon be acting on the Vannevar Bush recommendations that are the outgrowth of the wartime activities of the Office of Scientific Research and Development, which among other things was responsible for the early stages of the atomic bomb project.

Action on the Bush recommendations is expected to result in the establishment of some kind of a national research coordinating agency, with appropriations by Congress to support research work in the national interest. Some industries are establishing large research programs on an industry-wide scale. In the petroleum industry, numerous companies have announced large expansion plans for their research departments.

The executives of the A.A.P.G. are known to feel that with this vast expansion of research activities of all kinds, great advances in the field of oil exploration are possible. The association's survey is designed to achieve two purposes. First it will make it possible for all research organizations to know what is being done in the field of petroleum geology, and where. This should aid the workers on all projects. Second, it will bring out any duplication and overlapping research, with its attendant waste of time, money, and energy.

Production Experiments in McElroy Field Planned

AUSTIN.—Gulf Oil Corp. has applied to the Texas Railroad Commission for permission to conduct experiments in water flooding and gas injection at wells in the McElroy field, Upton and Crane counties.

Senator Moore Charges Britain With Discrimination Against U. S. Equipment Manufacturers

WASHINGTON.—Charges that Great Britain is deliberately discriminating against American manufacturers of oil-industry equipment by refusing to permit importation of such equipment into any part of the British Empire were made on the floor of the Senate last week by Sen. E. H. Moore of Oklahoma.

He read from correspondence he has addressed to the State Department citing instances of this policy, and replies from W. L. Clayton, assistant secretary of state, asserting that the matter is being given earnest consideration. Moore declared that British sources are unable to furnish equipment needed to rehabilitate foreign installations of American oil companies so that in effect this policy amounts to confiscation of the interests of American nationals.

Moore's charges were supported by Sens. Wayne Morse of Oregon and Bourke B. Hickenlooper of Iowa, who declared that this discrimination is part of a British policy of trade preferentials aimed at building up the so-called sterling area at the expense of United States export trade. Morse described it as a policy of international war against the United States.

Texas Allowables Restored With Refineries Busy

AUSTIN. — The original October oil order, authorizing a net daily allowable crude production of 1,785,089 bbl., was reinstated by the Texas Railroad Commission last week, upon return to virtually full operation of refineries which had been strike-bound. The commission set aside revisions which had been designed to cut production, owing to plant shutdowns. The new order went into effect October 12.

The allowable under the original October order was 207,152 bbl. less than that of September 15, a cut of 10.4 per cent. All districts except the Panhandle shared the decrease. The original order called generally for 21 producing days over the state with exceptions ranging down to 14 days and up to no shutdown days.

Oil and Natural-Gas Board Established in Alabama

MONTGOMERY.—Alabama's rapidly growing oil and natural-gas industry will now be under regulation of a board established by the 1945 legislature. Gov. Chauncey Sparks appointed Oliver Young of Vernon, former state senator; Milton Fies, Birmingham industrialist, and P. F. DeVane, former state senator from Choctaw.

The act creating the board set up a drilling tax of $25 a well and a 2 per cent gross receipts tax on gross value of production. The purpose of the law is to conserve natural resources, avoid drilling waste, and to regulate, control, and supervise production, drilling and use of oil and gas.

Amortizing Costs of War Facilities a Problem

NEW YORK.—Major oil companies, including Standard Oil Co. of New Jersey, Socony-Vacuum Oil Co., Inc., The Texas Co., Sinclair Refining Co., and Tide Water Associated Oil Co., are still studying what action to take in amortizing the costs of war facilities.

In many instances their tax experts and accountants are examining their profits in the war years and when their compilations are completed finance and executive officers will decide how the new plant costs should be entered in financial statements.

Commission Fixes 640-Acre Spacing Rule for Whelan

AUSTIN.—An order of the Texas Railroad Commission, signed by two members, with Chairman Olin Culberson dissenting, establishes a 640-acre spacing rule for the Whelan field, Harrison County. The order also changes the name of the field, formerly called Harleton.

Commissioners E. O. Thompson and Beauford Jester, constituting a majority, signed the order. Chairman Culberson said in dissenting: "I cannot concur in an order which, in my opinion, patently disregards the interests and welfare of the royalty owner."

The order in regard to spacing says: "For the purpose of establishing the allowables for a gas well in the Whelan field, Harrison County, the standard proration unit shall be 640 acre continuous and contiguous acres; provided, however, that a tolerance acreage of not to exceed 10 per cent of the standard proration unit shall be allowed on producing tracts of more than 640 acres when the size and shape of the tract warrants."

The order set forth that evidence brought out at the hearing on the rules September 18 showed that the probable productive extent of the structure from which the gas is obtained approximates 10,000 to 15,000 acres.

The rules provide, in addition to numerous detailed engineering regulations in effect in most gas fields, that in the Whelan field, no gas well hereafter shall be drilled at any point less than 2,640 ft. from and other gas well completed or that is drilling, or at any point nearer than 1,320 ft. to any boundary line of such lease.

Petroleum Electric Power Association to Meet

DALLAS.—The annual meeting of Petroleum Electric Power Association will be held in Dallas October 30-31. It will be devoted chiefly to discussions led by members.

DEATHS

James T. Black, 78, foreman for United Natural Gas Co. in Jefferson and Elk counties, Pennsylvania, when he retired in 1932, died October 6 in Kennerdell, Pa.

George S. McClelland, 83, oil producer of Raymilton, Pa., died October 10.

James A. Buchanan, 79, president and director of Bodcaw Oil Co., Texarkana, Tex., died October 11 in a Chicago hospital. Other interests included Nebo Oil Co. and Little Creek Oil Co.

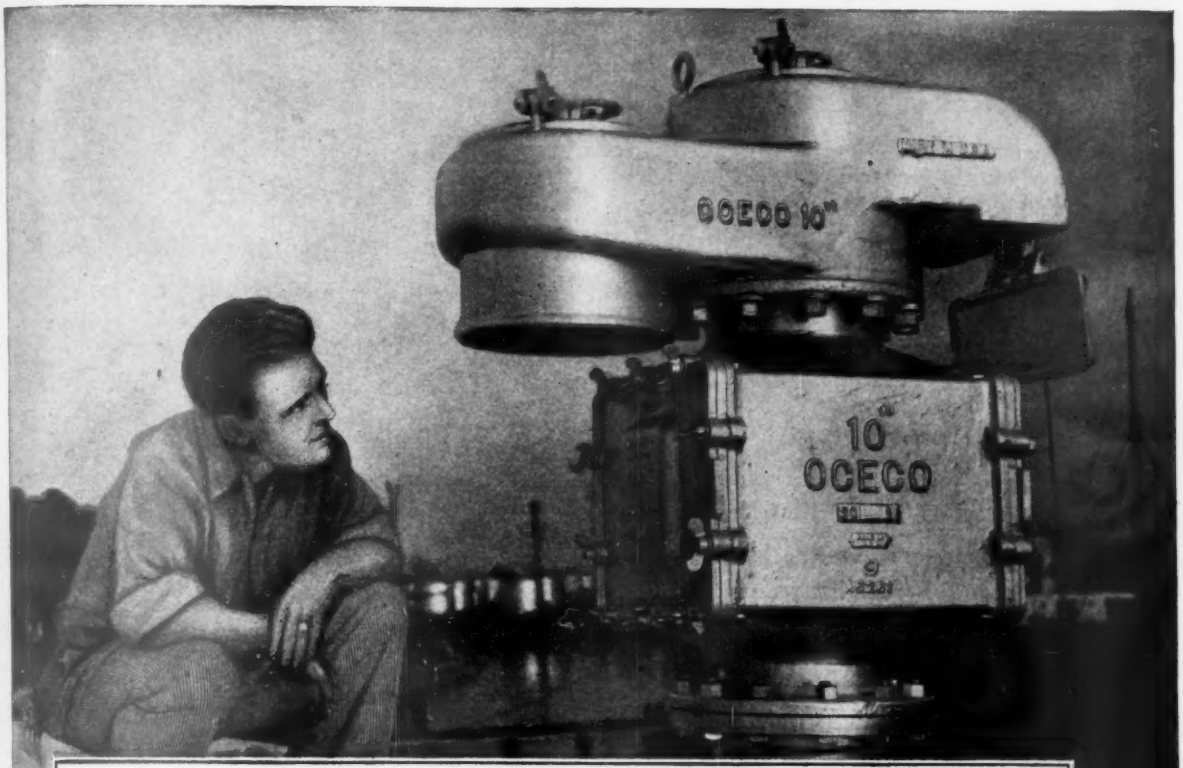
Robert G. Harper, 46, construction engineer for Gulf Oil Corp. in Tulsa, met death October 8 in an automobile accident near Hiawatha, Kans., while returning from a vacation in Nebraska and South Dakota. Harper was a graduate of Washington University, St. Louis, and of University of Missouri School of Mines and Metallurgy, Rolla.

John W. Mackenzie, 74, president of Crystal Oil Co., died October 6 in Elizabeth, N. J.

Samuel T. Robinson, 81, oil producer, died October 9 in Parkers Landing, Pa., where he had passed his life.

Frank Hodges, 52, district manager for Republic Supply Co. in Wichita Falls, Tex., died October 5 of a heart attack. He had been connected with Republic Supply since 1916.

R. C. Brosius, 58, for 40 years associated with Cities Service Gas Co., died September 29 in Joplin, Mo. He started to work for the old Artificial Gas Co., later merged with Cities Service. He became superintendent for the latter company at Hutchinson, Kans., and was made division manager at Fort Scott, Kans., before being transferred to Joplin.



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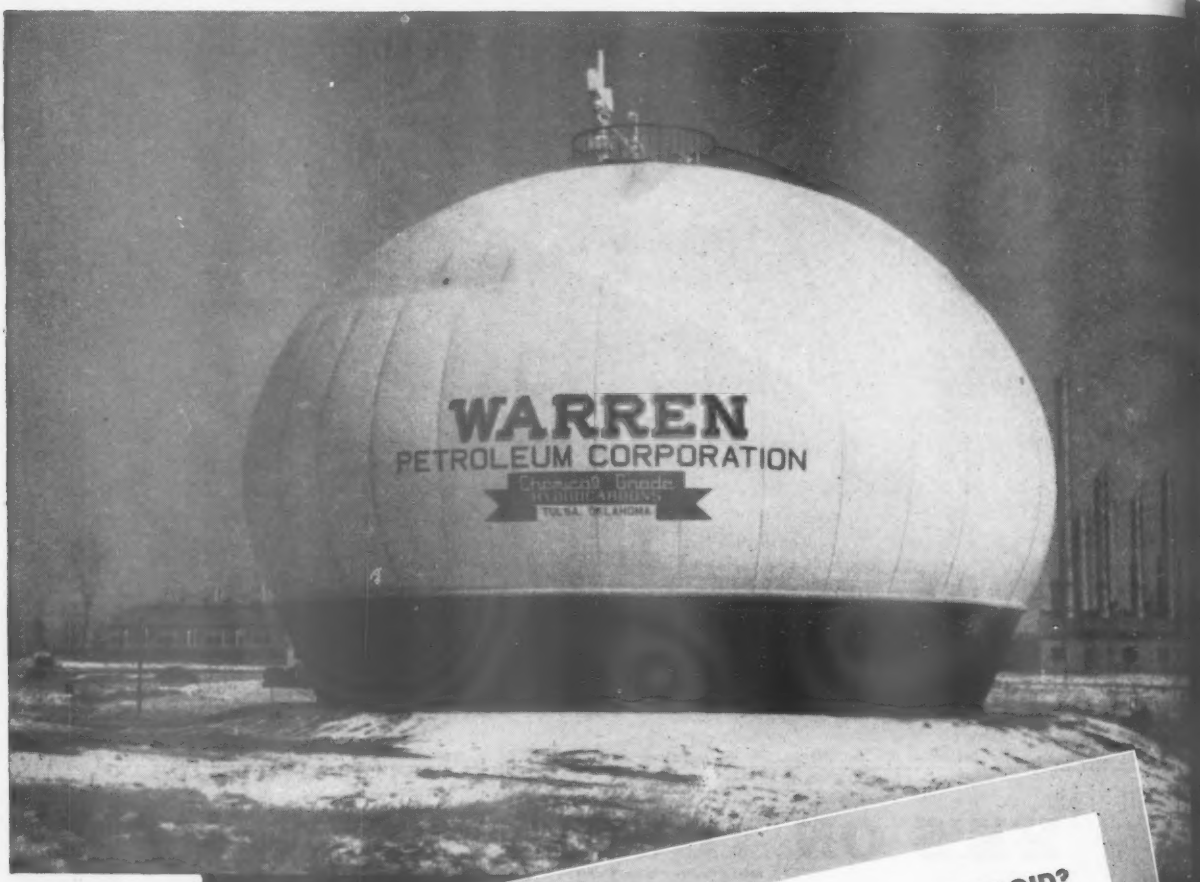
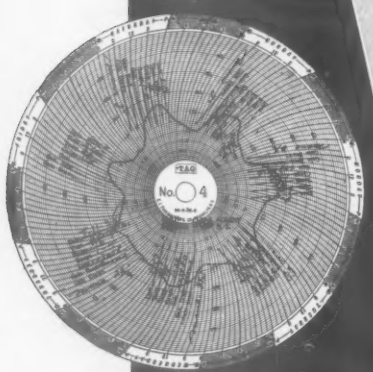


HOW EFFICIENT IS THE HORTONSPHEROID?

The efficiency of the Hortonspheroid is shown by a checkup at a typical marine terminal installation. This installation consists of one 80,000-bbl. and three 40,000-bbl. Hortonspheroids designed for working pressures of 2½ and 3 lbs. per sq. in. respectively, and six cone roof storage tanks ranging in capacity from 10,000 to 55,000 bbls. The Hortonspheroids are equipped with pressure recorders and a complete record for each vessel has been kept since the terminal has been placed in service. The charts show that the spheroids vented only when being filled and that no venting has occurred during periods of standing storage. A typical pressure chart for one week is shown at the left. During this period, the pressure ranged from 0 to 2 lbs. per sq. in.



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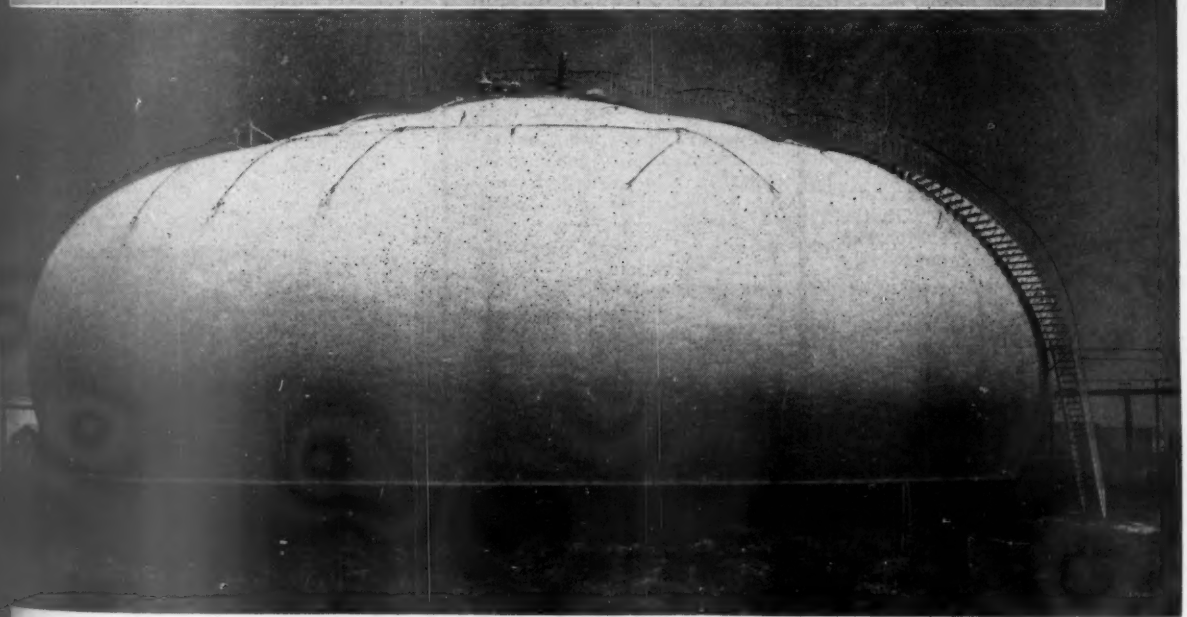
Hortonspheroids of the smooth type, like the one shown on the opposite page, are available in capacities of 2,500 to 40,000 bbls. for pressures up to 35 lbs. per sq. in. Noded Hortonspheroids, like the 80,000-bbl. installation shown below, are built in capacities of 20,000 to 120,000 bbls. for pressures of 2½ to 20 lbs. per sq. in.



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PRACTICAL PETROLEUM ENGINEERING

Fluid Flow

Graphic Solutions of Design Problems

1—Fluid Flow in Pipes

by Paul Buthod and B. W. Whiteley

FLUID flow in a broad sense involves all energy effects which, from a practical standpoint, must be known in order to state power requirements, discharge rates, and other design information.

For incompressible fluids and isothermal conditions, this is usually stated in the form of an energy balance as:

$$(1)\quad (y_1 - y_2) + \frac{(p_1 - p_2)}{\rho} + \frac{(u_1^2 - u_2^2)}{2g} - h_f + w_o = 0$$

where the symbols are explained in the accompanying notation. The w_o term is positive if the work is supplied to the system as by a pump and negative if work is taken from the system as by a turbine.

For compressible fluids where heat effects are involved Equation 1 is usually expressed in a differential form involving thermodynamic functions.

All of the terms involved in Equation 1 are straightforward with the exception of h_f, the friction-loss term. This may be computed by means of the Darcy equation:

$$(2)\quad h_f = \frac{flu^2}{2gd}$$

where "f" is a dimensionless friction factor which is dependent upon the pipe diameter and relative roughness of the pipe as well as the density, velocity, and viscosity of the fluid. In general "f" is a function of two, and only two, other dimensionless quantities. These are (ϵ/d), the relative roughness of the pipe surface and, $(du\rho/\mu')$ denoted as "Re" and called the Reynolds number after Osborne Reynolds, who first discovered its significance. By means of experiments using dyes, or light effects, it may be demonstrated that fluid flow in a pipe is divided into two broad types of flow. At Reynolds numbers under 2,000, fluid particles travel through the pipe in a straight line with the velocity varying from zero at the pipe wall to a maximum at the pipe center. This type of flow has been variously described as streamlined, laminar, or viscous.

Above a Reynolds number of 3,000 or 4,000, the fluid motion becomes turbulent, and individual fluid particles have no definite path or velocity. This type of motion is described as turbulent flow.

Between Reynolds numbers of 2,000 and about 4,000, referred to as the critical zone, the type of flow is somewhat indeterminate and may depend upon such factors as initial turbulence, entrance effects, obstructions in the path of the flow, and fittings. At certain velocities within this region, a turbulent zone may occur at a section downstream from the inlet and become damped out further along the pipe. There is also some evidence that turbulence within the critical zone may be intermittent in character.

The practical importance of the Reynolds number, however, lies in the fact that, knowing this quantity and the type of pipe, the friction factor "f" may be readily determined. This permits a reliable prediction of pressure loss, discharge rates, etc., for flow of liquids or gases of widely varying viscosities and densities.

This is in sharp contrast with the empirical formulas, in common use 10 or 15 years ago, which provided satisfactory results only for

PRESENTED here is the initial installment of a series of a dozen articles on the solution of fluid-flow problems. Dealing with the practical side of fluid flow in pipes and through granular beds, the article discusses present-day methods employed in determining pressure drop. More than 15 charts for the graphical determination of various factors employed in the solution of fluid-flow problems and for the calculation of pressure losses, are included in the series. Unique among the charts is that of Viscosity Correlation for Petroleum Liquids.

Covering the wide range of flow problems usually met in the petroleum industry with illustrative examples, the articles explain how the various charts may be used. Outstanding in the series is the overall simplicity of the graphical method of solving otherwise tedious operations. Based upon reliably correlated data, the charts will be found to show surprisingly accurate results in the final solution of many fluid-flow problems.

PAUL BUTHOD *B. W. WHITELEY*

IN their second series of "Practical Engineering," which begins with this installment, Paul Buthod and Burton Whiteley equal if not exceed the work of their previous series on heat exchange.

Outstanding engineers in their field, the authors have given the subject of fluid flow the treatment which popularized their methods for computing heat interchange. Both men have had a number of years of engineering practice.

Arthur Paul Buthod, after graduating in 1939 at Tulsa University with a B.S. degree in petroleum engineering, was employed by Pure Oil Co. in its research pilot plant. Returning to Tulsa University in 1941 to do graduate work on an Ethyl Corp. fellowship, Buthod received his master's degree in 1943. He has been an instructor in chemical engineering at Tulsa University since 1942.

Burton W. Whiteley graduated with a B.S. degree in chemical engineering from Oklahoma A. & M. College in 1937. Employed by Gulf Oil Corp., Gypsy division, Tulsa, upon graduation, Whiteley has been associated with the various branches of the petroleum industry for 8 years. A large part of his work has been in the study of equipment in the different company operations.

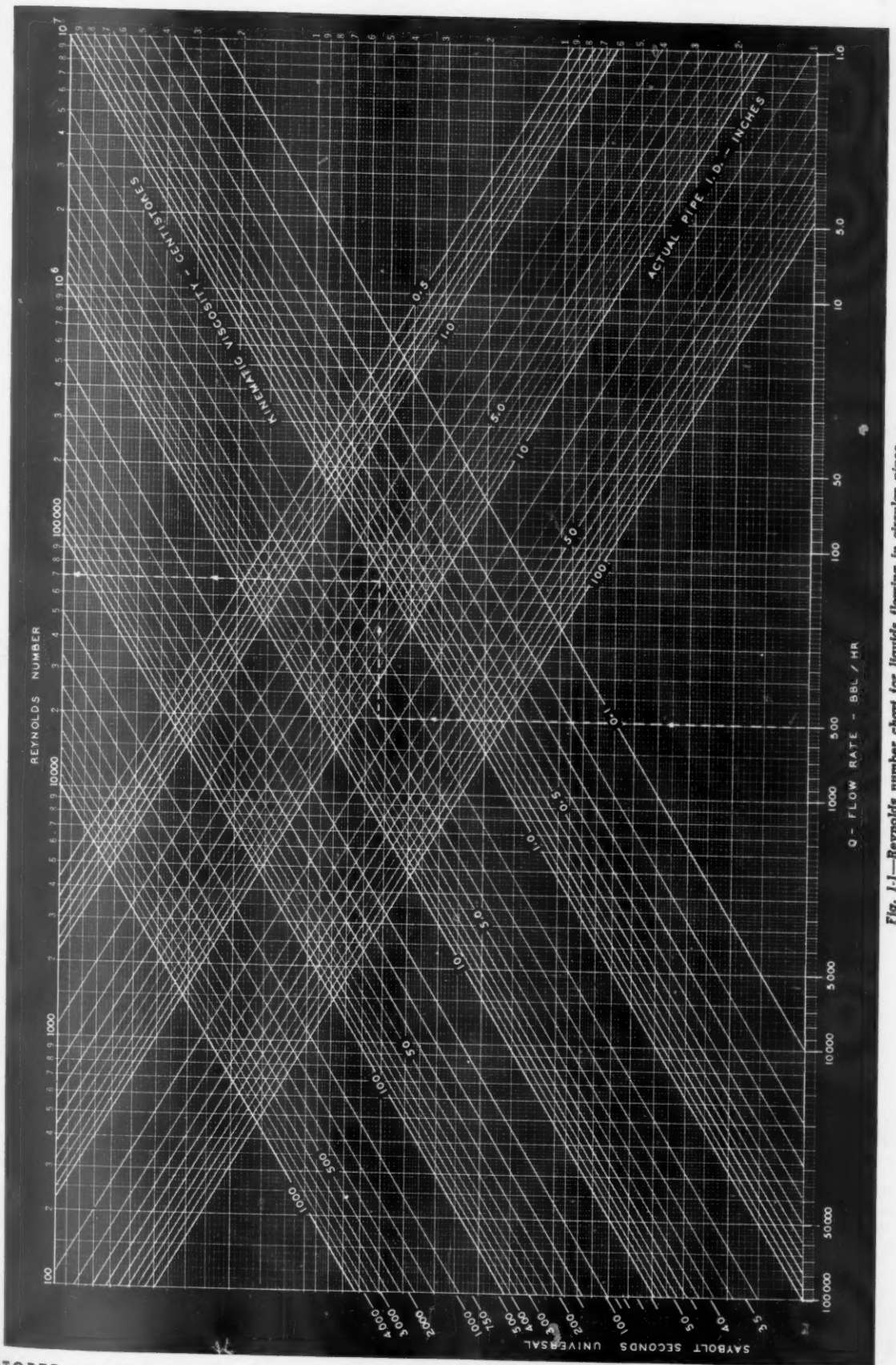

Fig. 1-1—Reynolds number chart for liquids flowing in circular pipes

specific fluids under limited conditions of temperature and pressure. Recent correlations of friction factors 1, 2, and 3 have gradually obviated the necessity of extrapolating these empirical formulas into regions of uncertainty.

Since the Reynolds number is dimensionless, it may be stated in terms of any consistent set of units. In terms of the different units commonly employed in engineering practice it may be written as:

$$Re = du\rho/\mu' = 124.0\ Du\rho/\mu = 22{,}750\ V\rho/D\mu = 35.5\ B\rho/D\mu = 50.7\ Q_L\rho/D\mu = 124.0\ DG/\mu = 22{,}750\ W/D\mu.$$

Using the kinematic viscosity in centistokes instead of the absolute viscosity (μ = zs):

$$Re = 7{,}730\ Du/z = 1.418 \times 10^6\ V/Dz = 2{,}215\ B/Dz = 3{,}160\ Q_L/Dz = 124\ DG/zs = 22{,}750\ W/Dzs.$$

The Reynolds number for particular flow conditions can be determined readily by the accompanying chart, Fig. 1-1. Use of this chart is illustrated by the following example:

Example.—Crude oil to a topping plant is flowing through a 4-in. i.d. line at the rate of 500 bbl. per hour. Kinematic viscosity of the crude is 4.0 centistokes. Determine the Reynolds number.

Solution. — Enter the Reynolds number chart on the bottom scale at a flow rate of 500 bbl. per hour. (Note that the scale is reversed, i.e., increases from right to left.) Rise vertically to a kinematic viscosity line of 4.0 centistokes. From this point move horizontally to a pipe inside diameter of 4.0 in., thence vertically and read a value of 70,000 on the top scale for the Reynolds number.

Notation:

- B = flow rate, bbl./hr.
- D = actual inside diameter of pipe, in.
- d = actual inside diameter of pipe, ft.
- f = friction factor, dimensionless
- G = mass velocity, lb./sq. ft.-sec.
- g = acceleration due to gravity, 32.2 ft./sec.^{2}
- h_f = friction loss, ft. of head
- l = length of pipe, ft.
- p = pressure, lb./sq. ft.
- Q_L = flow rate, gal./min.
- Re = Reynolds number, dimensionless
- u = velocity, ft./sec.
- V = flow rate, cu. ft./sec.
- w_s = shaft work term, ft.-lb./lb.
- W = flow rate, lb./sec.
- y = elevation head, ft.
- z = kinematic viscosity, centistokes, cm.^{2}/sec.
- ϵ = linear quantity in feet, representative of the absolute roughness of the pipe surface
- ρ = density, lb./cu. ft.
- μ = absolute viscosity, centipoises, gm./cm. sec.
- μ' = viscosity in English units, lb./ft. sec.

Subscripts 1, 2, etc.—points within the flow system.

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3. Pigott, R. J. S., "Flow of Fluids in Closed Conduits," Mechanical Engineering 55, 497 (1933).
4. Reynolds, O., Scientific papers, Vol. 2, p. 11.
5. Dodge, R. A., and Thompson, M. J., "Fluid Mechanics," McGraw-Hill Book Co., New York (1937).

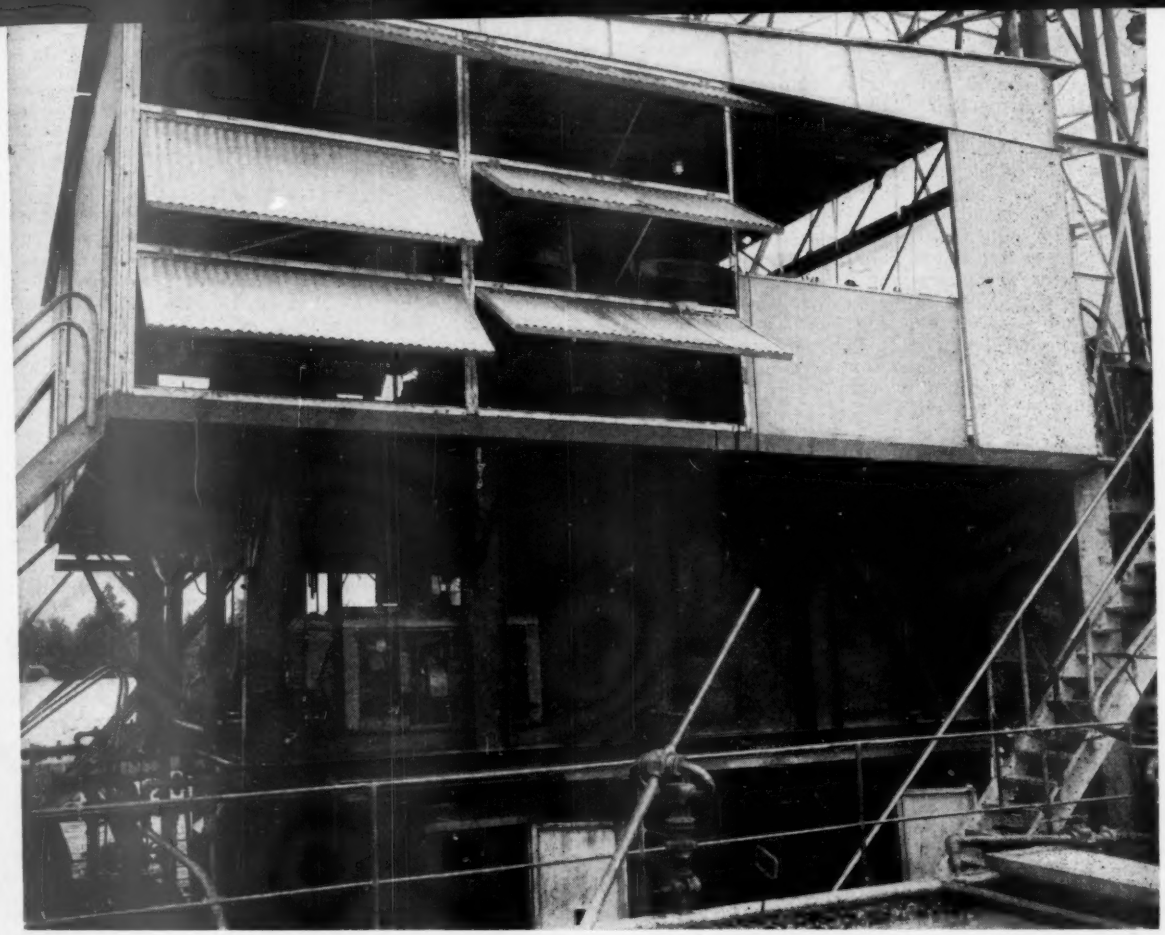
Norman Grosch, Clarendon, Pa., has been elected president of Appalachian Drilling Contractors Association. Other officers chosen are: First vice president, **Milford Loop,** Rixford, Pa.; second vice president, **I. H. Sporer,** Bradford; treasurer, **Milton Titus,** Bradford; executive secretary, **G. G. Bauer,** Bradford. **O. S. Blackman,** Allentown, N. Y., was reelected vice president for that state.

Walter S. Parker, who in 53 years of service has maintained a perfect safety record, accepted recently on behalf of Standard Oil Co. of Indiana an award "for distinguished service to safety" from National Safety Council. The Whiting refinery will be entitled to fly the "S" pennant of the council by reason of its 1944 record, an accident-frequency rate of only 10 per cent of the average for plants of the same type and an accident-severity rate of only 30 per cent of the average. Parker, who was selected to represent the company in receiving the award, is night superintendent of the light-oils division at the Whiting plant.

Direct Fuel-Injection Now Used

NEW fuel-feeding systems were used to shoot pressurized sprays of gasoline directly into the engine cylinders of the four 2,000-hp. engines which supplied the get-away power for the two Superfortresses which dropped atomic bombs on Hiroshima and Nagasaki. The direct fuel-injection mechanism, which has been used on all of the latest model B-29's, employs two small injection pumps. The pumps are synchronized with the main engine driveshafts to divide accurately the fuel into equal parts and pump it at high pressure into the individual engine cylinders. Each pump itself contains nine finely machined plungers which spray the high-octane gasoline into the cylinders in a series of tiny shots. The rate amounts to one spray from each plunger every 20th of a second when the engines are operating at maximum speed. The gasoline is conducted to the cylinders through stainless-steel tubing. Injection pressures range from 500 to 2,500 psi. The fuel-air mixture-control devices used in the system both meter the fuel feed according to the mass rate of engine air consumption, and provide for automatically controlled variation of fuel-air ratios as desired for different conditions of engine operation, including automatic mixture enrichment for high power requirements.

Cutaway model illustrating the new direct fuel injection system used on the latest B-29 Superfortresses. Left to right: F. C. Mock, manager of Bendix-Stromberg engineering; John Marshall, direct-injection project engineer; and C. D. Manhart, manager of Bendix-Stromberg aircraft fuel-equipment sales



Side view of one of two engine-fuel and water-tank units mounted as part of engine substructure (see Fig. 1), showing engine housing. This unit carries two generator units (on back half of skid floor). Second tank unit (set in parallel on opposite side) carries two compressor units. View is from top of steel mud tanks

Substructure-Design Innovations Feature Modern Diesel-Powered Rig

by Neil Williams

TWO identical direct diesel-powered drilling rigs recently assembled and now being operated in South Mississippi by Lyle Cashion, Ltd., incorporate a number of advancements not only in unitizing and utilization of rig space but also in provision of means to insure greater protection and well control in drilling. Many of these are developments of ideas of rig design and operation originated by Cashion. The assemblies as a whole are made up of some of the largest and most modern equipment being made available for deep drilling by the various manufacturers represented.

Both rigs are drilling under contract for Gulf Refining Co. The one described and pictured in this article is on a deep wildcat test on the Bradshaw dome, Marion County. The other is in the Soso area, Jasper County, where deep gas-distillate production recently was opened.

Of particular interest in the setup of each assembly is the substructure design. Both the derrick and the engine substructure are 18 ft. high. In the case of the derrick substructure, this height was provided to give ample clearance below the derrick floor for the well-control hookup without need for use of a cellar. By elimination of a cellar not cnly is there greater working space for setting up or dismantling the heavy blowout preventer assembly but all connections and controls are more accessible and with less hazard involved from possible gas leaks.

The derrick substructure is designed with open-V sides, and all center support and bracing are directed to the four corners, leaving the interior, and access to it, free of all obstructions for setting up or working around the well-control assembly. Load of the upper structure is transmitted to the corners through an intermediate cross member on each side at a height of approximately 10 ft. with bracing to the top main connecting member forming the sill for the derrick floor. Rotary load is carried by two parallel 36-in. I-beams extending from back to front. Under each end of both these beams an additional leg is provided in the structure for their

support. Corners and rotary beam legs are tied together at the bottom by the sills extending around the structure.

Base of the structure rests on a grillage constructed of 8-ft. lengths of 12-in. I-beams laid side by side across the width of the front and back sides and extending beyond the corners. The underlying foundation is a double 3-in. timber mat. An additional flooring, elevated 10 in. above ground level, is laid across the top of sills and connecting basal members to facilitate working inside the structure without danger of tripping or working in mud.

Engine Substructure

The engine substructure is made up of four main utility units, thus utilizing space below the engine floor that ordinarily might be wasted, and at the same time increasing the compactness of the rig and simplifying the moving and setting up the structure. Two of these units, one a tool house and the other a change house, form the lower part of the structure. The other two units, which contain the specially designed engine-fuel and water tanks and auxiliary pumps, as well as the generator and compressor units, rest on top the tool and change-house units. The tops of their frames, with an over-all height of 18 ft. on a level with the derrick floor, serve as the base for the engine floor.

The framework of a standard 8-ft. steel substructure was used in construction of the tool and change-house units. This was divided into two sections, each having a width of approximately 8 ft. to conform with transportation limitations. The houses were built into these sections by walling the sides and ends of the frames of the sections with sheet steel, leaving an opening and installing a door in each end. Each was completed with a sheet-metal floor and roof, the latter being slightly arched for strength and to allow water to run off. The sheet metal was placed on the interior sides of the frame, giving smooth interior walls and allowing the framework to afford protection to the housing during moves. Both houses are of welded construction and their walls give extra strength and bracing to the substructure. The change house is equipped with lockers and a shower room. The fabrication was done by Mason Construction Co. of Houston.

As a part of the substructure, these units are set in parallel lengthwise with the width of the derrick substructure and spaced about 4 ft. apart their support under the ends of the two upper units. Their foundation is a double 3-in. timber mat the same as under the derrick substructure.

Floor plan of the two fuel and water tank units which form the upper part of the engine substructure is indicated in Fig. 1. These units are skid mounted, each approximately 8 ft. wide and about 22 ft. long. They set in parallel directly on the top frame of the lower two units at each end and at right angles to them. Each skid has a superstructure 10 ft. high, the top of which serves as the engine floor.

Tanks for engine fuel and rig water supply occupy the front half of each skid and are built into the superstructure. The tanks have a combined capacity of 96 bbl. of floor water for general rig use; 80 bbl. of diesel fuel, and 16 bbl. of distilled water for engine radiators. Floor water is contained in compartments constituting the front half of the tank of each skid unit. When these units are set up, these compartments, each containing 48 bbl., are connected with a line so that the water can be pumped from both compartments. On one skid, the remaining half of the tank is divided into three 16-bbl. compartments, two for diesel fuel and one for distilled water. On the other skid the remaining half of the tank is divided into two 24-bbl. compartments, both containing diesel fuel.

Water and Fuel Pumps

Small electric-motor-driven centrifugal pumps for circulating the water and fuel also are permanently mounted on these skids at the back of the tanks. These include a pump supplying the hydromatic brake, another the brake drums and a third the floor water for general use, all taking suction from the two floor water compartments. Water requirements for the rig are greatly reduced since water circulated to the hydromatic brake and brake drums, etc., is returned to the tanks. A fourth pump circulates the diesel oil to the engine-fuel system. This takes suction from a header which connects all four diesel-fuel compartments, so that the fuel can be taken from any or all compartments as desired. A fifth pump is provided for the distilled-water compartment, circulating to the engine radiators.

One of these skid units also carries the two rig generator units which are permanently mounted on the back half. At present the generators are driven by gasoline engines but these will be replaced with two Branch-Krachy diesel-engine-driven 25-kw., 3-phase, 110-220-volt units when they can be obtained since the main fuel of the rig is diesel oil. Two compressor units are mounted on the back half of the other tank skid. One of these is driven by an electric motor and the other by a gasoline engine. These supply air pressure both for starting the rig diesel engines and for the air-operated hydraulic pump for the blowout-preventer control system. Auxiliary pump, engine and compressor equipment was supplied by Worthington Pump Co., Continental Motors Corp., and Fairbanks-Morse Co.

Tops of the two tank skid units are spaced and braced by a steel frame, the side members of which overlap and rest on, and are secured to the inner top superstructure members of those units. This extends the length of these units over the space between them. The front end ties into the derrick substructure and provides a supporting base for the rear of draw works and transmission units which extend back over it a distance of approximately 4 ft. The main engine skids set on cross members in the frame provided for their support. The frame is approximately 4 ft. wide, but the end and cross members are hinged at their mid points so that the frame can be folded into a unit about 2 ft. wide for handling during rig moves.

Engine-house flooring consists of steel grillage which covers the entire area around the engines, extending about 4 ft. outward around all sides for walkways and working space. That part over the tops of tank skid units is bolted to these units and remains in place when the units are moved, but may be removed if low head room so dictates. The side and end extensions are supported by collapsible arms, which allow the extensions to fold down against the sides of the units or be detached as desired. Both the tank units and their upper structure and grillage were fabricated by North Texas Steel Co. of Fort Worth.

Mud Pump Hookup

Housing for the engines is of steel construction supplied by Allied Steel Co. This is 32 ft. long and 29 ft. wide with a front height of 13 ft. and back height of 10 ft. It is specially designed with opening flap sides for maximum ventilation during warm weather.

Mud pumps are set on the ground level at the back of the rig. These include two 7¼ by 12-in. Clark triplex power pumps for drilling circulation, and a 5 by 10-in. Gardner-Denver power pump for mixing and jetting. The triplex pumps are V-belt driven from the engine floor, one from a power takeoff on an extension to the shaft of the rear, or No. 3 engine and the other from the takeoff from the middle, or No. 2 engine. The duplex mixing pump is independently driven by a Cummins 110-hp. (at 1,200 r.p.m.) diesel engine.

Power for the rig is supplied by three Cummins diesel engines, each rated at 225 hp. at 800 r.p.m. These operate through a selective compounding unit, making any or all

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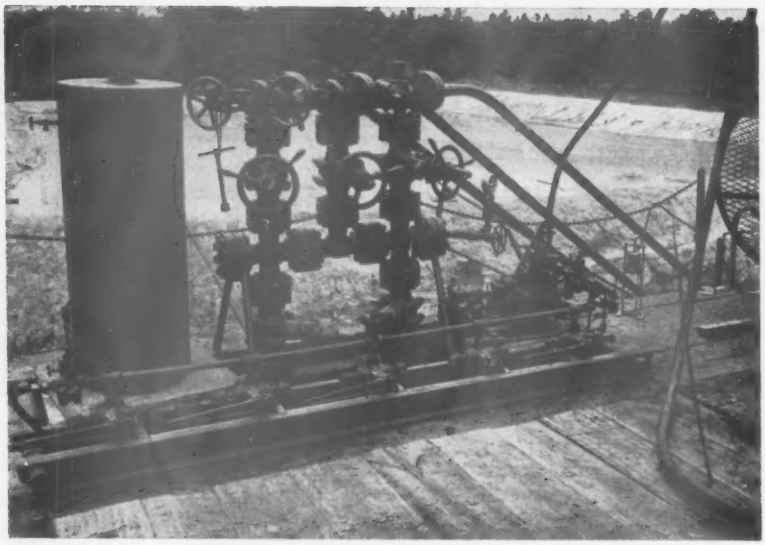


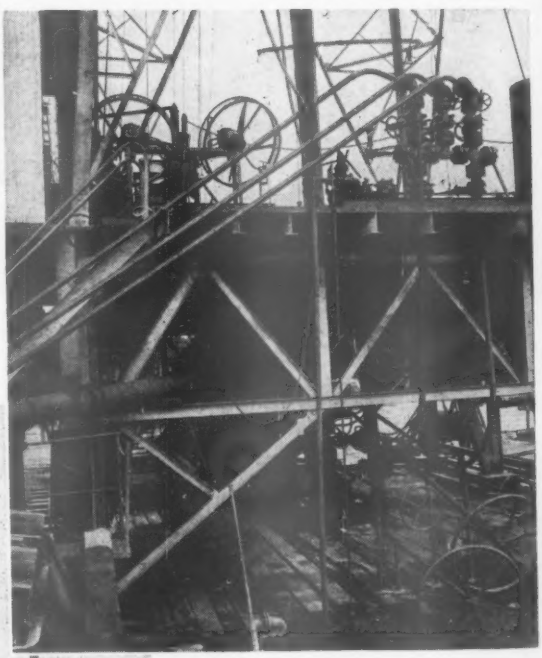
Blowout preventer hydraulic ram control and back-pressure-manifold assembly on derrick floor. Small air-operated hydraulic pump at right end of skid unit takes suction directly from floor water system. Water tank at left, at present not connected, will be used later. Header to hydraulic ram controls on floor of skid has connection (left end) from mud-pump line for emergency use. Three lines from mud-return back-pressure-control manifold lead to mud tanks at side of rig

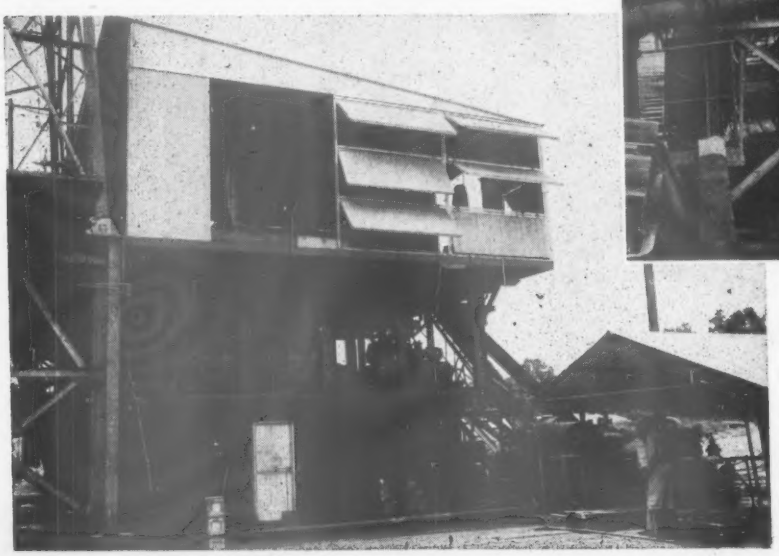
As shown in Fig. 1, the individual fuel feed pumps of the respective engines take suction off a common header line from the discharge of the emergency fuel tank supplied from the diesel-oil tanks below the engine floor by the main fuel pump. Excess engine fuel is circulated continuously through the emergency fuel tank on the rig floor, and thence through an overflow outlet line back to the diesel-oil supply tanks. The overflow outlet is located near the top of the emergency tank to insure keeping the fuel supply in the tank at capacity level. The inlet line from the header also enters the tank near the top to prevent the oil draining back through the fuel pump in the event of fuel pump or line failure and permit the emergency fuel supply in the tank to be drawn on when needed. Should the main fuel pump fail to function, the individual engine feed pumps will draw on the emergency fuel tank automatically without any break in operations. The sight glass feed will show that the emergency fuel tank is being emptied, giving notice of failure of fuel.

of them available for hoisting, rotating and mud pumps separately or together.

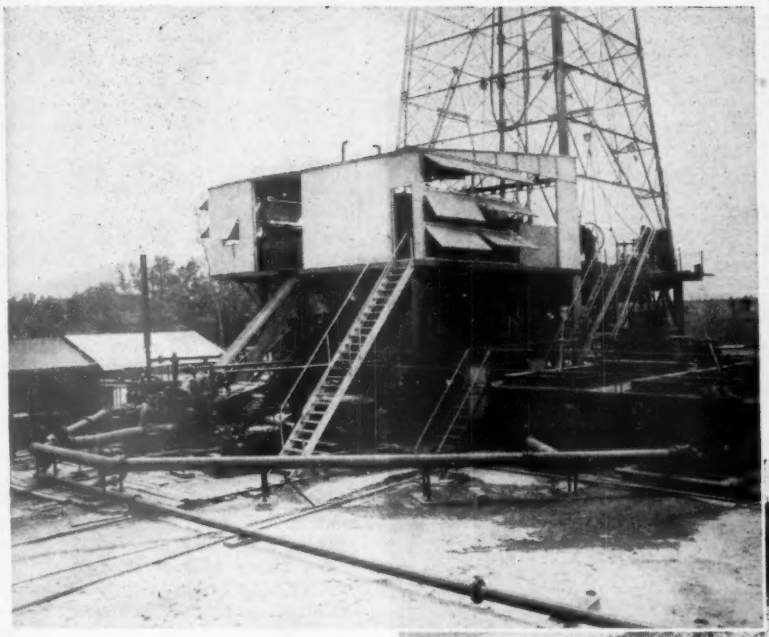
Engine fuel is taken from a continuous circulating system (Fig. 2). In the system there is an emergency fuel tank on the rig floor. This is located at the back of the draw works on the driller's side. It contains 105 gal. of fuel, which is a sufficient supply to operate the engines long enough to get the pipe out of the hole in an emergency should something go wrong with the main fuel pump. It is kept full by the continuous circulation of fuel through it in operation of the system.

Engine substructure design showing open V side and unobstructed interior for free access to drilling-control assembly below derrick floor. Blowout preventer hydraulic ram control and mud-return back-pressure-manifold installation is shown on derrick floor at top



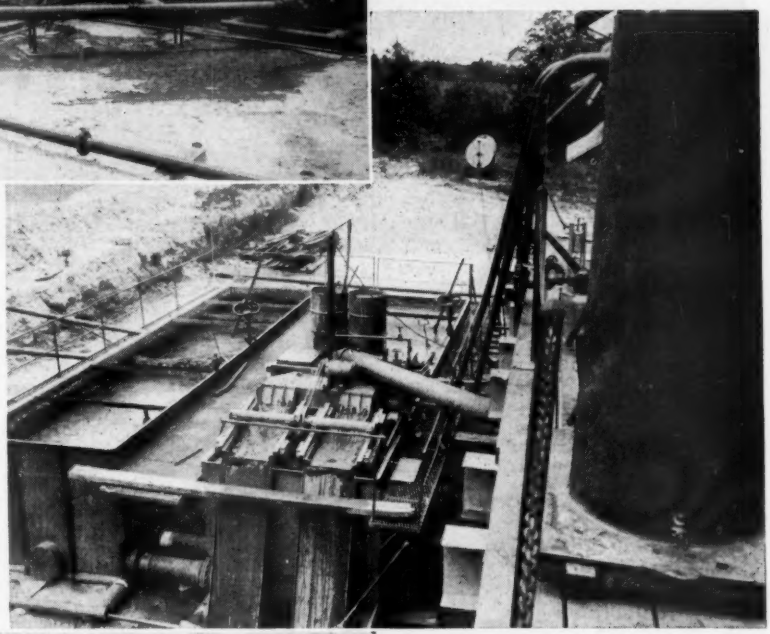


Left: Side elevation of engine substructure set up and engine house (opposite side from picture on first page) showing two doghouse units at bottom (tool house, left, and change house, right), with engine-fuel and water-tank-and-compressor unit on top. Gable-type steel building at right is mud house



Left: Back of rig showing general set-up and mud pumps at ground level with extended V-belt drives from engine floor, and unitized 10¾-in. suction-line system from the two mud tanks. Independently driven duplex mud mixing pump is shown at right of the two triplex mud-circulating pumps. Back of pumps is the gable-type steel mud house

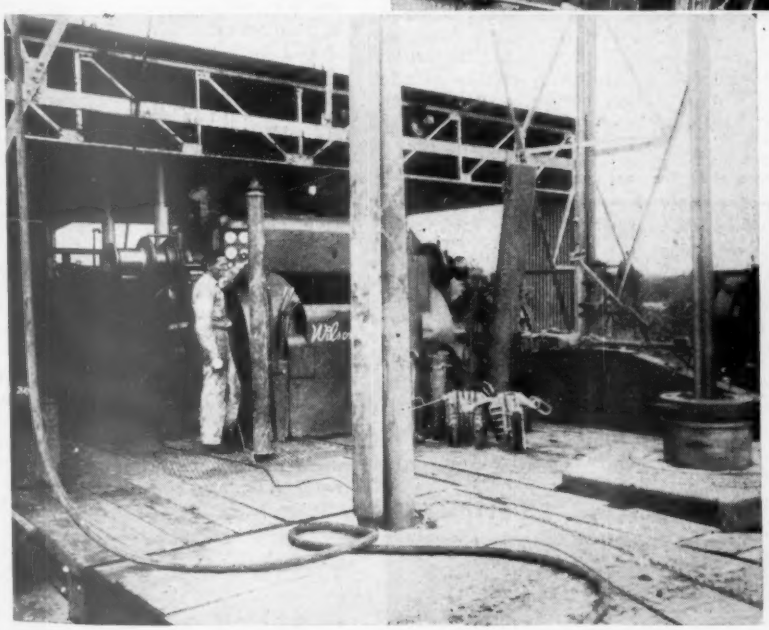
Below: Mud tanks with shale shaker mounting (front end of first tank) as viewed from derrick floor. Steel-grillage walkways around and between tanks collapse against sides of tank for moving. At right is water tank on blowout-preventer control unit. Lines from back-pressure-control manifold to shale shaker flume are shown at side



In addition to the 3,360 gal. (80 bbl.) of diesel storage capacity provided by the four compartments in the substructure tank skids, a reserve fuel storage capacity of approximately 2,500 gal. is provided by a National Tank Co. skid-mounted cylindrical steel tank unit kept at the rig. This tank, mounted horizontally, is 17 ft. long and 5 ft. in diameter with 3/16-in. wall. A small line connects this tank with the rig tanks through which the reserve can be pumped to the rig.

The rig was assembled through Mid-Continent Supply Co. of Fort Worth. The rig proper is a Wilson Manufacturing Co. Titan model with vacuum-operated controls and chain-drive transmission and designed for 15,000-ft. drilling. It is equipped with a Parkersburg dual rotor hydromatic brake and Foster catheads, including not only the automatic and spinning units but also a master breakout cathead. The rotary is an L.F.M. Co. 23-in. Universal Streamline type, chain driven from the draw works rotary jackshaft.

A Parkersburg steel 136-ft. derrick with 30-ft. base and 5½-ft. crown is a part of the rig assembly, this being furnished by the contractor. The 30-ft. substructure previously described, and also the 24 by 69-ft. steel pipe rack are of the



Left: Derrick floor looking into engine house. Barely visible at back of drawworks behind cathead is the emergency engine-fuel tank (Fig. 2) containing sufficient fuel supply for engines to get the pipe out of the hole should main fuel pump fail at a critical time

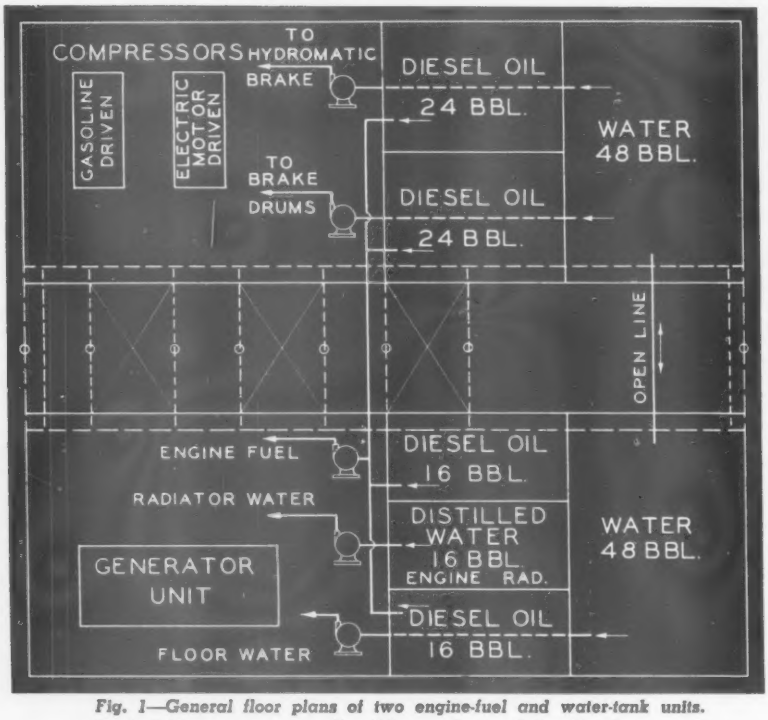


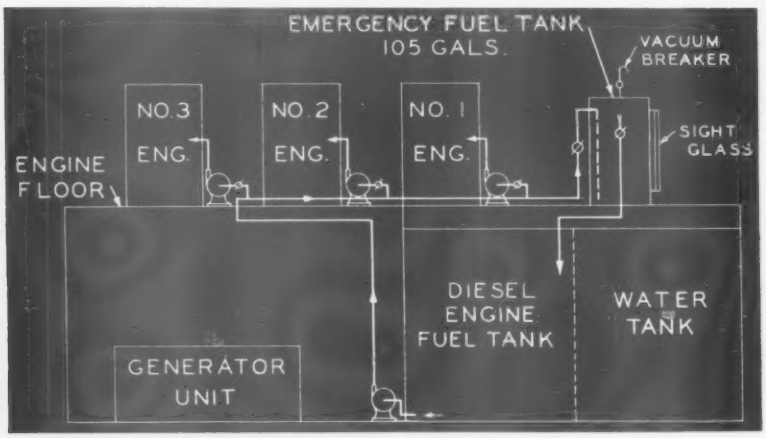
Fig. 1—General floor plans of two engine-fuel and water-tank units. Dashed lines represent collapsible spacing and bracing frame unit

same make. In the derrick is a Deckard adjustable monkey board with racking capacity of 12,000 ft. of 4½-in. o.d. drill pipe.

The Reagan crown and traveling blocks have 7 and 6 sheaves, respectively, permitting the string of 12 lines. The crown block includes a cathead sheave attachment. Sheaves are grooved for ¼-in. line, and 2,500 ft. of American Excelloy Monitor steel 6 by 19 line is strung. With the traveling block is a 300-ton-Byron Jackson Super-Triplex rotary hook and 2¾-ft. by 108-in. elevator links. A 6-in. Gray Tool Co. swivel with 55 ft. of 3-in. Hewitt rotary hose and a Baash-Ross 5¼-in. solid-forged upset hexagon kelly with 13½-in. square kelly bushing with 5¼-in. hexagon assembly, and 4½-in. long drill pipe slips are being used. Approximately 10,022 ft. of National Tube 4½-in. o.d., 16.60-lb. seamless A.P.I. internal upset drill pipe, equipped with Hughes 6-in. o.d. hard-faced, flash weld tool joints is on hand.

Coring is done with a Hunt Tool Co. wire-line coring unit using a 15,000-ft. capacity reel, driven by a 110-hp. (at 1,200 r.p.m.) Cummins "H" diesel engine. Approximately 12,000 ft. of ⅝-in. 6 by 7 American sand line is provided. The unit is placed at the side of the derrick floor. When coring, a Brown circulating head is installed on top the drill stem above the rotary table. With this head, which also permits rotation of the pipe and mud circulation, the wire-line core barrel can be run in and pulled from the hole without leaving the top of the pipe open at any time. Circulation is maintained through a 2-in. Chiksan all-steel, swing-joint rotary hose, from a connection to an auxiliary mud standpipe.

Fig. 2—General diagram of engine fuel system



Control equipment on the well includes a Cameron 6,000-psi. test master gate and a 10,000-psi. test blowout preventer with quick change rams. All rams are hydraulically operated from a control manifold on the derrick floor. Control lines are 6,000-psi. burst test Aeroquip flexible hoses. Hydraulic power for operation of the rams is provided by a small air-operated water pump, recently developed by Gardner-Denver Co. At present this pump takes suction directly off the floor-water system, but a 100-gal. water tank is being installed on the control unit for this purpose. As a precaution against possible failure of the hydraulic pump at a critical time, the hydraulic control manifold has a small line from the mud-pump discharge to permit use of the mud pressure.

Unitized with the blowout-preventer control manifold assembly is a choke manifold hookup for back pressure control on the mud returns from the well when desired. This consists of a header arrangement to which the mud returns can be directed through either or both of two 2½-in. return lines from wing connections on the preventer. From the header manifold there are three 2-in. lines to the mud receiving box at the shale shaker and pits. Two of these lines contain adjustable chokes, while in the third there is a positive choke. When necessary to apply back pressure to control the well, the mud returns first are directed through the 2-in. lines having the adjustable choke, in which the opening of the choke can be varied to determine readily and closely the amount of back pressure needed. When this is known, a positive choke of the desired restriction is placed in the positive choke line and the returns then are switched to that line. This operation is controlled entirely from the derrick floor by the driller or other responsible person.

Mud returns and suction pits consist of two 8 by 30-ft. by 6 ft. deep steel tanks, fabricated by Mason. They are mounted on pipe skids to facilitate moving as units. Walkways, constructed of steel grillage extend around the top on all sides and between them, making any part of the tanks readily accessible. They are equipped with guard rails for the safety of crew members.

(Continued on page 144)

SECURALOY CUTS EXPLORATORY COSTS!

Here is the way many operators doing exploratory work are cutting costs and at the same time increasing the accuracy and safety of their testing operations.

When they drill into a sand with productive possibilities, instead of setting and cementing a string of casing and running a liner, they cement a combination liner and casing string made of "Securaloy."* As illustrated (fig. 1), this string is cemented in place through ports in the casing at the top of the producing zone, using a basket below the ports, if desired.

By using a Security Left Hand Releasing Tool the operation is made extremely simple and positive, for this tool not only assures positive release but has a built-in packing device and tail pipe connection that facilitates the cementing operation. At excessive depths ports should be provided in the blank section of the string to equalize any pressure differential. When this is done a swab cup is placed on the tail pipe to prevent by-passing of the cement through the equalizing ports during the cementing operation.

After the combination string is set the well is placed on production. If the sand proves productive, it can be produced as long as desired through the "Securaloy" Combination String.

But if the zone proves non-productive—or not sufficiently productive to warrant further development at the present—the entire combination can be quickly drilled up (fig. 2), circulated out of the hole, and the well completely cleared for further drilling operations!

MONEY-SAVING ADVANTAGES

Notice the important savings which this method makes possible. In the first place, a full string of casing is saved each time a production test is made. That alone is an important economy.

But consider also that if the zone is non-productive the combination casing-liner string can be completely removed and the drilling carried on *without reducing hole size.*

And there is this additional feature—since the liner is part of the casing string, maximum size pipe can be used in the producing zone, assuring full *unchoked* production flow from the test sand—a vitally important point regardless of whether the zone is being fully produced or merely tested!

Full particulars on this or any other "Securaloy" application will gladly be sent upon request.

* "Securaloy," besides being completely drillable, is also soluble in certain acids, and is thus subject to chemical removal should occasion arise. "Securaloy" is available in all pipe and tubing sizes, as well as in the form of heavy wall extrusions, forgings, bar stock and castings. This advertisement illustrates only one application of "Securaloy." There are many others. A postcard will bring you a complete "Securaloy" Catalog.

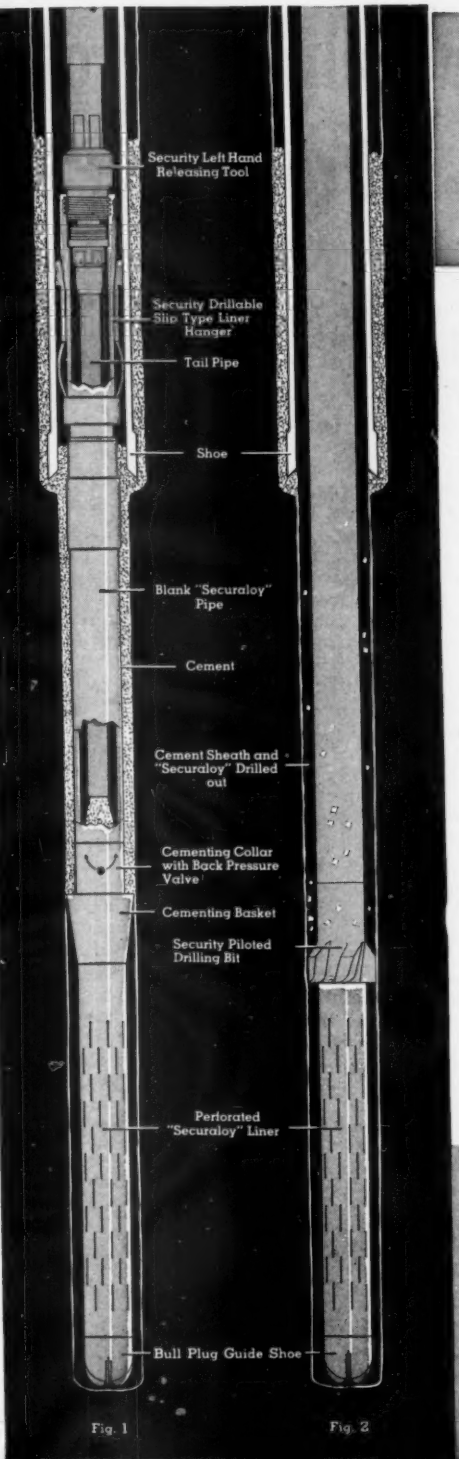
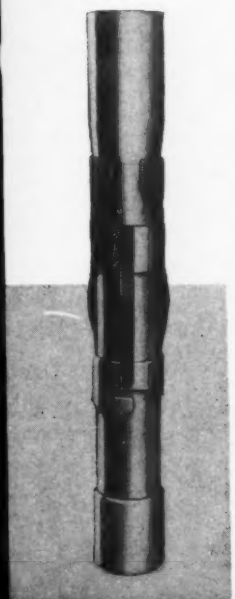


Fig. 1 Fig. 2

The Security DRILLABLE SLIP TYPE LINER HANGER

This liner hanger is similar to conventional slip type liner hangers except, being made of "Securaloy," it can be completely drilled up and circulated out of the hole whenever desired . . . It is ideal for supporting the combination liner-casing string described at left as well as for ordinary liner work where "Securaloy" equipment is used . . . It is available in all standard sizes, either with or without lead seal ring.



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Branches in All Principal Oil Fields

Controlling Corrosion in Refineries Processing Sour Crudes

by W. H. Creel

THE cause and the control of corrosion in petroleum-refinery equipment is subject to many variations. The methods of refining, impurities in the crude oil and the water used for cooling and condensing are usually the major factors considered when selecting construction materials for specific equipment. Laboratory tests are quite helpful as a guide in selecting materials which will successfully resist attack. Fortunately, however, the refining industry has now accumulated sufficient experience in full-scale plant operations so that a reasonably practical and economical solution has been found to most corrosion problems. Due to technological developments and resulting obsolescence, it is usually considered economical to select the least expensive materials which will yet offer sufficient resistance to give a reasonable service life.

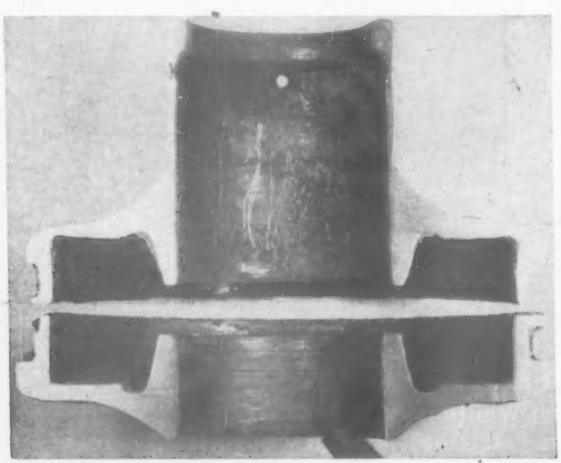
The following discussion refers primarily to the equipment used, the problems encountered, and the solutions developed in refining crude oils produced in the various fields of the Texas Panhandle. Although other refineries operating on high-sulfur crude, from this or other areas, may, due to variations in their operations, variations in the crude processed, or both, encounter somewhat different problems, the general type of corrosion should be similar and the alloys required to economically resist this corrosive action, should be the same.

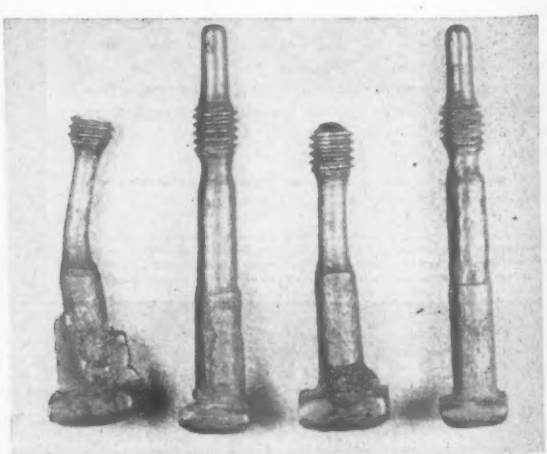
W. H. Creel has had many years' experience in the petroleum processing equipment field. A large part of his activities have been in the study of equipment corrosion. Creel has been connected with Phillips Petroleum Co.'s refinery-engineering department since the company entered into the refining branch of the industry.

The information here presented is based on the experience gained in approximately 17 years of actual operations, as determined by thorough and frequent inspection of the equipment used. In 1936 Phillips Petroleum Co. set up an inspection department as an independent unit in its Borger, Tex., plant. The department is headed by a safety engineer who reports directly to the superintendent of the refinery. The safety engineer has under his direction a sufficient number of qualified inspectors who handle the inspections of all processing equipment and keep up-to-date records of their findings. Prior to the organization of this department, inspections were handled by experienced men in the operating department, assisted by engineers from the mechanical department.

Where a question of the safe operating condition of the equipment is involved, the decision of the safety engineer is final, subject only to the approval of the plant superintendent. Where the findings of the inspectors indicate a change in construction material specifications is desirable, the safety engineer reports such conditions, with or without his recommendations, to the mechanical superintendent. In the majority of cases a satisfactory and economical solution will be developed by the engineers at the plant. Such problems as cannot be locally solved are referred to the central engineering office for handling. A group of engineers at the refinery, a departmental engineering organization in the central office at Bartlesville and a testing laboratory operated for the benefit of the entire company, work in close cooperation with the safety engineer and with each other on any problems which may arise in connection with the selection of the most economical materials for any specific application.

In the company's Borger plant, which operates on crudes from the various fields in the Texas Panhan-





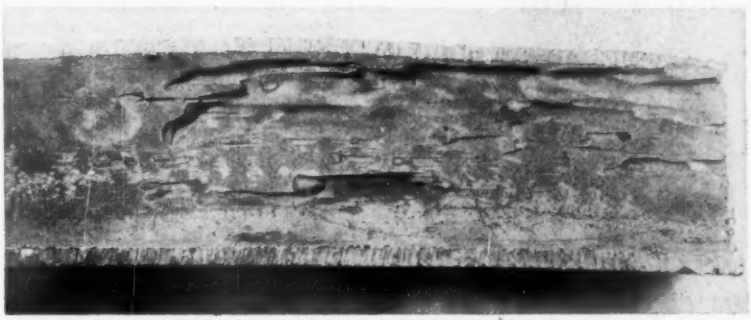
Left: View of cross-sectioned copper-alloy wear rings removed from a refinery gasoline pump. Presence of hydrogen sulfide in gasoline was responsible for heavy corrosion of these parts. Right: Bubble-cap bolts from hot-oil separator. Replacement of these bolts, which were manufactured of low-carbon steel, was made with stainless steel

dle, extensive use of chrome alloys in furnace tubes, process piping, and pumps has been found necessary. Flash separators and fractionating columns are at least partially alloy lined and chrome-alloy tubes are used in all gas-oil and fuel-oil heat exchangers.

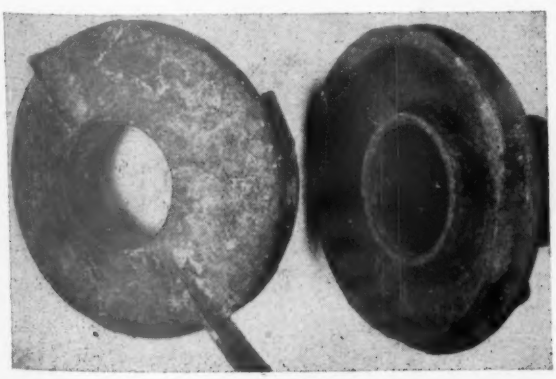
Five per cent Cr., 0.5 per cent Mo. has been the most extensively used alloy for furnace tubes. This alloy gives a service life of 1½ to 5 years, depending upon the specific conditions under which the tubes are operated. In general the topped-crude service is the most severe and the average life of 5 per cent Cr. is less than 2 years. Gas-oil cracking is also a very severe service and the average life is between 2 and 2½ years. In reforming service, the average life is between 4 and 5 years. Recently, 7 per cent Cr., 0.5 per cent Mo. tubes have been tested in cracking service and indications are that the higher alloy will have a service life several times that of the 5 per cent chrome alloy tubing. The slightly higher cost is obviously justified and the changeover from 5 per cent to 7 per cent Cr. is now being made whenever it is necessary to replace any of the tubes on topped-crude or gas-oil cracking units. Nine per cent Cr., 1.5 per cent Mo., considerably more expensive than 7 per cent Cr., while possibly justified in some cases due to its combination of high-temperature strength and corrosion and oxidation resistance, does not appear to be economically justified on the basis of corrosion resistance alone. For extremely high temperatures and severe oxidation, 18-8 has proven to be the most economical alloy to use.

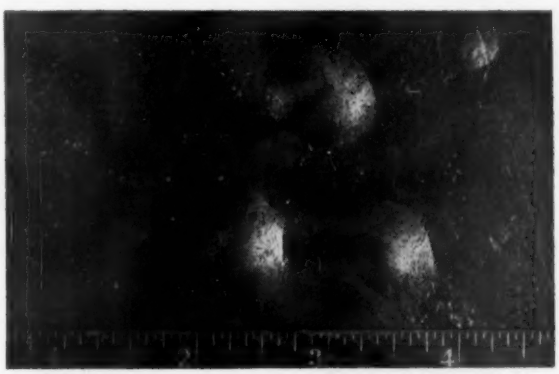
Furnace tubes are designed for 1 per cent creep in 10,000 hours, using the latest adaptation of the Bailey formula. Wall thicknesses thus determined are modified as necessary to provide a reasonable allowance for corrosion and oxidation. After the desired thickness has been determined, a tube, standard with this plant, is selected which will most nearly meet the requirements. Retirement thicknesses are based on 1 per cent creep in 3,000 hours. While it is recognized that all known methods, of calculating required

Bronze throat bushing which served for 7 years in a pump handling butane at 110°-140° F. Presence of hydrogen sulfide in the butane caused deep pitting which in turn resulted in failure of bushing. Bushing shows an analysis of 1.55 per cent tin, 0.22 per cent lead, 95.01 per cent copper, and 2.86 per cent zinc. Replacement was made with copper bushing



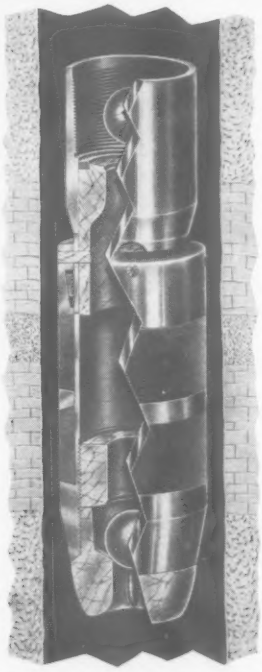
Section of a 5 per cent Cr. Mo. 8-in. Schedule 80 pipe bend removed from a transfer line between a heater and a hot-oil separator. The bend had been in service for 38 months at operating temperatures of 740°-750° F. and 90-95 psi. Test results show variation in hardness of the section as running between Rockwell B73 to 82. Recommendations for the replacement bend were larger-diameter pipe for reducing turbulency and the use of higher-alloy material such as 7 or 9 per cent Cr. Mo.





Left: Severely corroded wear rings which were removed from a gasoline pump. These rings, made of an alloy containing 0.25 per cent antimony, 9.11 per cent tin, 10.75 per cent lead, 79.28 per cent copper, 0.28 per cent nickel, and 0.16 per cent zinc, were replaced with rings made of 11-13 per cent Cr. steel. Right: Bubbles caused by hydrogen diffusion in the steel sidewalls of vessel which was operating in refinery service

Cementrol



Bridging ball above valve seat. Shoe is in running position, with packer element unexpanded

Ball seated, Bakelite sleeve has moved down, shearing pin, exposing side ports and expanding packer elements against wall

LARKIN Cementrol Equipment was developed to provide a means of overcoming well completion difficulties caused by cement intrusion into the open oil and gas bearing formations below the casing seat.

Contamination and impaired productivity, due to cement intrusion into the producing zone, is a possibility in every well where casing is cemented above an exposed porous and permeable formation of only average pressure.

In a wide sector where such formations are typical, one major operator reports as a result of a survey that "The most outstanding finding was the fact that in one well out of three, cement was found below the shoe (conventional). The degree of cement invasion into the producing formation could not be accurately determined, but it was evident that in many cases wells had been permanently damaged by cement contamination of the potential producing formation."

Further on in his letter this same operator in reference to the Larkin Cementrol Shoe stated "As the shoe is now designed and offered to the industry, it should do the job for which it is intended. We have had complete success with its use in the wells in which it has been run. We are continuing to use the Cementrol Shoe in wells in which we cement casing on top of the producing zone. We have found that the shoe shortens the time required to clean up the formation when the plug is drilled as well as prevents the infiltration of cement into the formation during cementing operations."

Four applications, either suggested or developed by operators, are illustrated on the opposite page.

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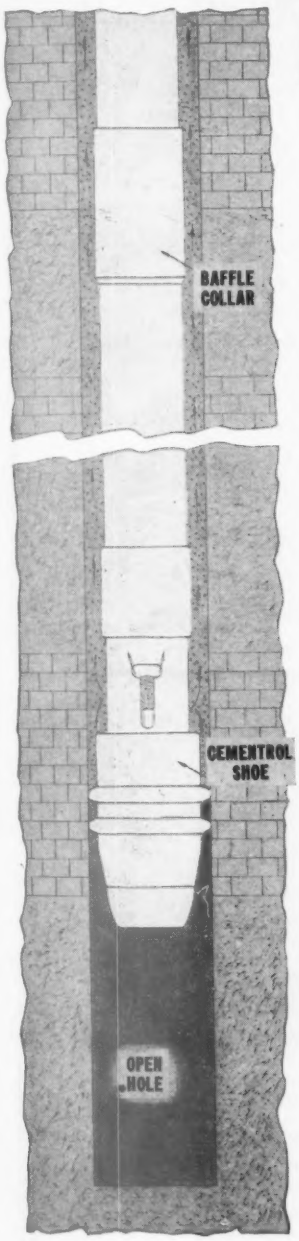
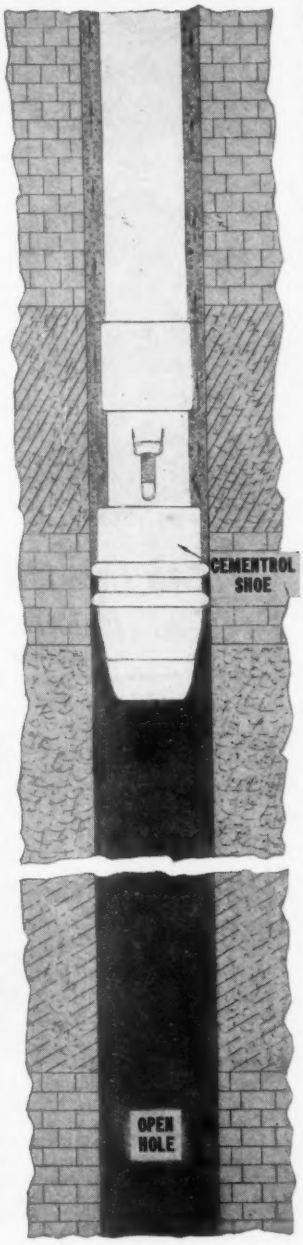
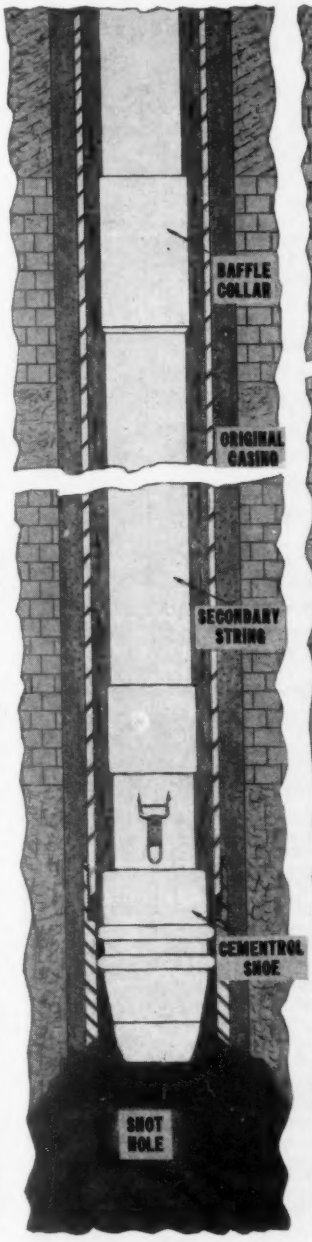
FOUR USEFUL APPLICATIONS



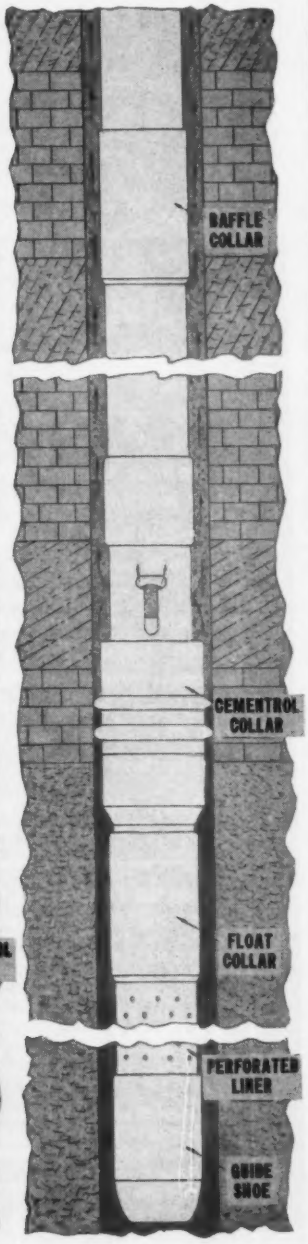
1. Protects permeable low pressure producing zones immediately below casing seat.



2. Prevents downward movement of cement to open hole in wells where considerable open hole exists below pay zones, even though the zone is of low permeability. Downward movement may be caused by mud being forced into some lower, more permeable formation.



3. Protects partially depleted formations when cementing inside strings. Eliminates gravel packing or other plugging methods and minimizes clean-out costs.



4. Cementrol Collar permits running of perforated liner into permeable zones. The liner is run as part of the casing string.

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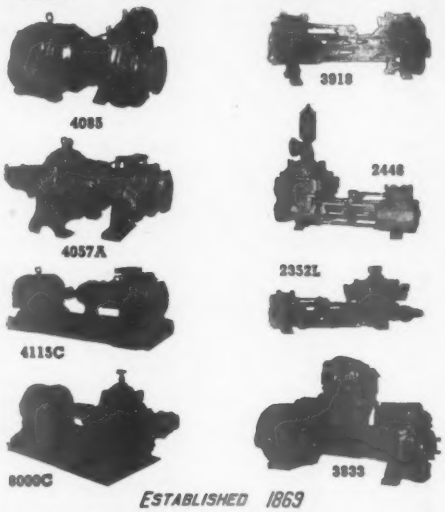

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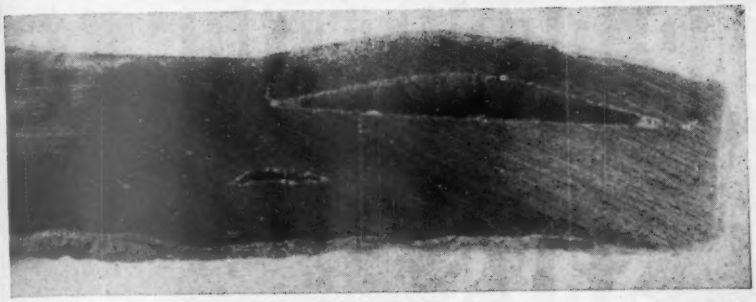
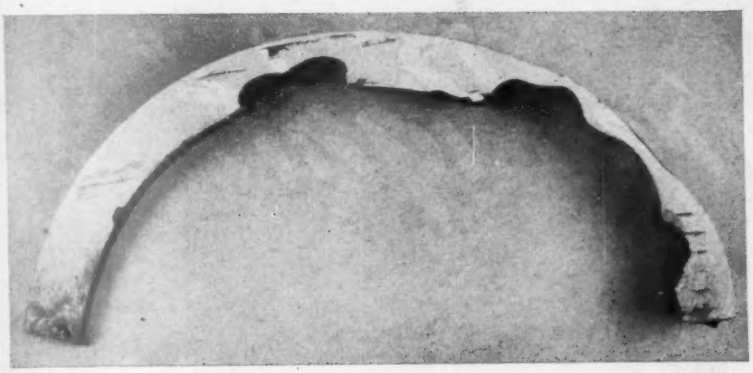


Cross-section through typical hydrogen bubble. The smaller bubble has not reached the proportions where its presence would be discovered by superficial examination of the steel



Cross-section of the 5 per cent Cr. Mo. pipe bend section shown in another photograph

tube wall thicknesses, are subject to some error, we have found that the above described procedure to be reasonably satisfactory. Probably the greatest inaccuracy is due to an incorrect allowance for the effect of any coke film. Engineering studies are now under way in an attempt to develop a more accurate method of evaluating this factor. As an economy measure, tubes that have reached a retirement thickness for cracking still service, but otherwise are suitable for use under less severe conditions, are transferred to crude distillation or rerun operations.

At temperatures above 600° F., topped crude, fuel oil and gas oil have been found to be severely corrosive and the use of 5 per cent or higher chrome alloys are required. Below 450° F., a reasonable service life can be obtained with carbon steel. In the range between 450° F. and 600° F. so many variations occur that no general rule is applicable. Unless prior experience indicates otherwise, it is usually preferable, in this range, to use carbon steel initially and replace carbon steel with chrome alloys only if and when economically justified.

Except that furnace tubes are subjected to some oxidation, the recommendations as to the proper alloys for furnace tubes will apply to pipe, valves and fittings.

In the severe service sections or zones, heat-exchanger construction runs to 5 per cent or higher Cr. alloy for the tubes and baffles but carbon steel is usually satisfactory for tube sheets, shells, channels, floating heads, etc. The satisfactory service given by carbon steel in the various heat-exchanger components is probably due to low velocities in the regions of the components and to the greater thickness of the parts.

Selection of Materials

Except for the major factor of erosion in centrifugal pumps, the selection of construction materials for pumping equipment follows the same general pattern as is carried out for other process equipment items. Carbon steel for centrifugal pump cases and for reciprocating pump cylinders usually proves satisfactory for operation at temperatures of 450° F. and lower. Although carbon steel pump cases are frequently used for operation at temperatures above 450° F. the use of 5 per cent Cr. pump cases is usually justified for operation at this temperature range. Corroded cases have been successfully reclaimed by building up the corroded areas with 25-20 welding rod.

It has been found economical to use corrosion and abrasion-resisting alloys, such as 18 Cr.-8 Ni. and 25 Cr.-12 Ni., for such centrifugal pump parts as shafts, shaft sleeves, throat bushings, impeller and case wearing rings, and impellers. The same is true of reciprocating pump parts such as rods, valves and valve seats. Where erosion or abrasion is particularly severe, excellent results have been secured by using parts coated with Stellite or Colmonoy. In cases of abrasion, such as pump plungers which are exposed to dust and sand, excellent results have been obtained with a 12 Cr.-0.2 C alloy, heat treated to 500 Bn. hardness. As an additional measure to prolong the life of exposed pump plungers, all installations which are operated without protection of pump houses or of other buildings, are provided with dust tight enclosures.

Refinery vessels are, with very few exceptions, constructed of carbon steel. An allowance for corrosion, between ⅛ and ¼ in., depending upon the expected rate of corrosion, is provided. If severe corrosion is expected in certain zones or sections, these zones or sections are usually lined with an alloy liner. The most commonly used alloy for this purpose is 12 per cent chrome. For temperatures above 700° F., 4½-in. wide strips, welded along the sides and ends to the shell of the vessels with 25-12 or 25-20 rod are used. For lower temperatures wider strips are used. For service at or near atmosphere temperature, wide sheets may be used satisfactorily. Plug welds on approximately 6-in. centers are used to attach relatively wide sheets to the vessel walls. Gannister linings cast in place and Lumnite cement linings applied with a gun have also been used, but are generally not as satisfactory or effective as alloy liners. A metalized coating of aluminum, 0.018 to 0.020 in. thick, will provide effective protection at a very reasonable cost. However, this type of lining will usually require some repairs at least once a year. Monel metal liners have been used successfully to combat HCl corrosion. If, when the vessel is being designed, the rate of corrosion is unknown, it may prove economical to omit any liners until the need is determined. Alloy strip liners can be installed after the vessel has been in service with only a nominal increase in down time over that normally required for periodic inspection and repairs. Even if excessive corrosion has occurred, (in excess of any allowance for corrosion) providing it is localized, a vessel can be restored to a serviceable condition by welding a carbon steel wrapper plate on the outside of the vessel at these areas or zones.

Materials for the internal parts of vessels are selected based on previous experience. If no experience is available the usual procedure is to use carbon steel and replace as necessary. In crude and cracking-still bubble towers, when processing sour crudes, it is usually economical to use alloy caps, chimneys and bolts. If light-gage, pressed metal is used, 13 per cent chrome is general-

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But the Borium-protected tooth at the bottom operated for 40 days and wore only ½". It was simply resharpened in the forge, retipped with Tube Borium, and put back on the ditcher for another 40 days' service.

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These tungsten carbide particles do not melt when tube is applied but are held in suspension in a mild steel matrix forming a deposit resembling coarse sandpaper.

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ly very satisfactory except for the top tray in crude distillation towers; when HCl is present, monel is the preferred alloy. In some instances it has been found economical to use 13 per cent chrome in the lower two or three trays. If a stripping section is used, it may be economical to make the tray immediately above the feed point and all trays below of a corrosion resistant alloy such as 13 per cent chrome.

Atmospheric pressure and temperature storage tanks, both those in crude service and those in product service show very little evidence of corrosion if provided with floating roofs. However, with cone roofs, both the roofs and supporting steel may corrode rather severely. Corrosion of tank bottoms is usually from the outside and can largely be prevented if the necessary steps are taken to keep the bottoms dry. Ample drainage plus a coarse gravel or rock base are usually effective.

Hydrogen diffusion in steel is being studied by Phillips' metallurgists, to determine the extent of its presence in refinery processing equipment. Because the phenomenon in all its aspects is apparently not understood by most engineers outside of the field of metallurgy, little, if any, discussion on the subject of hydrogen diffusion in steel has been published in petroleum-trade journals. As a matter of interest to those not familiar with the process of hydrogen diffusion in steel the following paragraphs briefly describe this phase of the subject.

In the reaction of hydrogen sulfide with carbon steel the sulfur radical combines with the iron to form ferric sulfide thereby releasing nacent hydrogen; there is some tendency for the hydrogen thus released to diffuse into the steel. Under certain favorable conditions this hydrogen may collect in blow holes, slag inclusions, laminations, or other discontinuities in the steel. Over a period of time sufficient pressure may be created by the pocketed hydrogen, to form a "bubble" or "blister" which will gradually increase in size until its rupture allows the hydrogen to escape. The formation or growth of blisters is usually very slow because only a small part of the released hydrogen penetrates the steel; hence serious trouble may normally be avoided by reasonably frequent inspections. Inspections at yearly intervals will usually disclose the presence of blisters before serious damage occurs. If of appreciable size, the blisters, in most cases, when discovered should be punctured to release the hydrogen, the bulge hammered back in place and the hole welded. In extreme cases the blister may have to be tapped from the outside for periodically bleeding off the accumulated hydrogen.

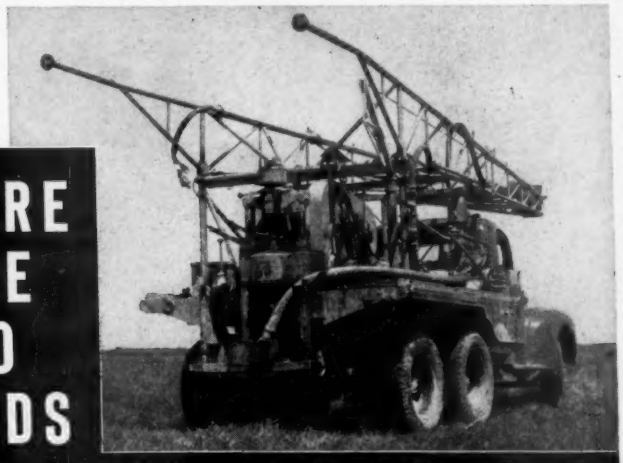
In addition to causing blisters, hydrogen diffusion tends to reduce ductility and causes what is known as "hydrogen embrittlement." As in the case of highly stressed bolts, the use of alloys less susceptible to this phenomenon, is often justified.

There is much to be learned about the diffusion of hydrogen in steel and about its effect on the properties of metals. However, it is known that the capacity of steel to absorb hydrogen is materially increased with an increase in temperature.

R. M. Prather, formerly with Westvaco Chlorine Products Corp., has joined the recently organized chemical products department of Standard Oil Co. (Indiana), to be in charge of market-research activities. He is a chemistry graduate of Rutgers University.

Charles Leahy, of Vermilion, Alta., has left for Caracas, Venezuela, under a 2-year contract with Seismograph Service Corp. of Delaware.

E. J. Ruwaldt, oil producer, who moved to San Angelo, Tex., in 1942, but continued to have his headquarters at Mount Vernon, Ill., has transferred his main office to San Angelo.



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The newly designed Model L Winch Tractor is another contribution by Fred E. Cooper — Allis Chalmers, to more efficient well servicing with improved equipment. It is the product of twenty-six years of service to the production division of the Oil Industry.

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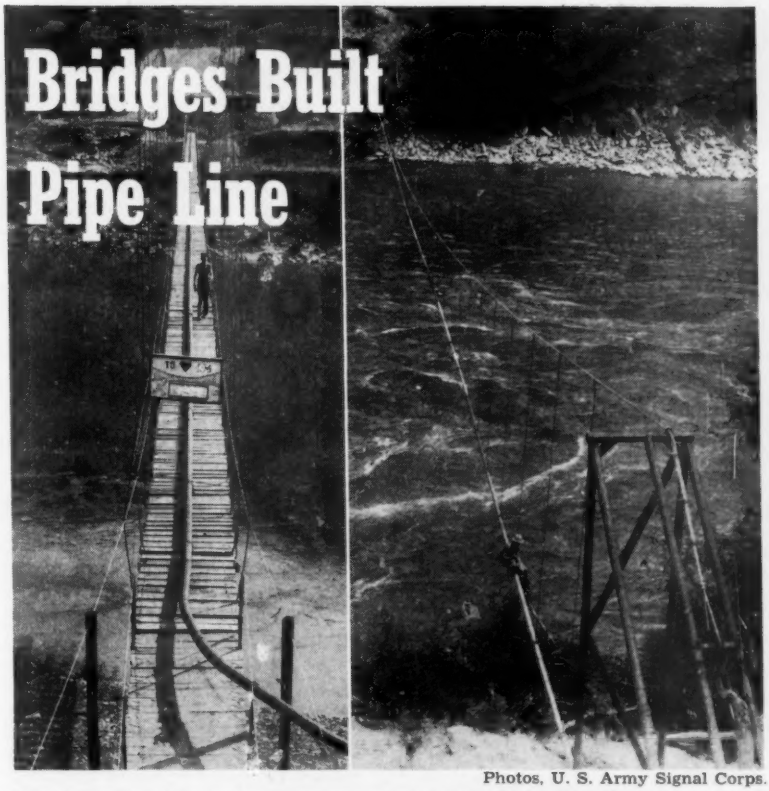
Suspension Bridges Built For China Pipe Line



Photos, U. S. Army Signal Corps.

Left: Suspension foot bridge supporting coupled line. Right: Welded framework and equipment for adjusting the length of cable supporting pipe across river

by Paul Reed

STEEL cable was used extensively in the construction of the India-Burma-China products pipe line. Suspension bridges supported the line over numerous rivers and streams. Furthermore, many miles are reported to be suspended from cables in the mountains and over the twisting Stilwell road. At several locations cables were also used for trolley lines utilized for moving pipe and supplies into spots in the jungle or over streams which otherwise would have been inaccessible. However, as would be expected, at wide rivers at many stream crossings pipe was buried in stream beds.

The most spectacular suspension bridge on the entire China pipe line, according to information furnished by the United States Forces, India Burma Theater, was that over the Salween River gorge where the elevation drops from 7,500 to 2,500 ft. in less than a horizontal mile.

A 600-ft. bridge, weighing approximately 25 tons, was built over the stream before any of the regular supplies for the job arrived. This was strong enough to withstand a 75-m.p.h. wind; it was anchored so that vertical wind currents would not damage it. The structure was fabricated entirely of material salvaged in the area. In spanning the Salween River with pipe, no bridge equipment was used which came from the United States.

Immediately after the Japanese were driven from Salween River and even before the Stilwell Road was entirely free of hostilities, engineers began work on the span over the gorge. Cable was recovered from bridges wrecked by bombing. Trucks and tanks were cannibalized to obtain plates and parts.

While excavating was being done, welders built frame work of heavy pipe for the cable connection at each bank. Chutes 800 ft. long were made from old oil drums left along the road. Gravel and cement were trucked to the job; 30 tons of cement was poured for each anchorage and 8 tons for each pillow block.

The first line across the river for this bridge was a rope carried over an old Burma Road bridge in the vicinity; this rope was dragged up both banks to the suspension site. The steel cable was fastened to this and pulled across.

Trolley cable for moving pipe, supplies, and men across a gorge

Prefabricated in Sections

A foot bridge was prefabricated in sections on one side of the river; this was held over the river by lines suspended from the main cables. At either end of the suspension bridge, wheels from Japanese tanks were used in the equipment to allow for expansion and contraction of the bridge due to changing temperature.

In the locations along the pipeline route where simple cable suspension was used for crossing fairly narrow ravines, the work was usually done without difficulty. An H-frame was set in concrete at each side, cable with adjusting equipment was installed; pipe was coupled at one side, suspended from the cable by hanger equipment, and slid along under the cable until it reached the other side of the ravine. By this

method there was little strain on the pipe, and the job was readily accomplished.

For building the cable trolleys used for moving pipe and supplies into locations difficult to reach, it was common practice to anchor the cable to a tree at the receiving end and to a heavily ballasted truck at the other end.

Ralph L. Fillmore has resigned as assistant chief geologist for Anderson-Prichard Oil Corp. and formed a partnership with **R. R. Sheets.** They have opened an office in Oklahoma City.

Substructure-Design Innovations

(Continued from page 130)

They are supported by collapsible arms to the sides of the tank and can be folded down against the tanks to be moved as a part of the tank units. In use, the tanks are located parallel at one side of and in close proximity to the rig to shorten mud return lines and to make them quickly accessible from the rig floor by a short walkway connecting the rig steps.

A dual-type Link Belt mud screen is mounted as a part of the unit on top at one end of the return tank nearest the rig. This empties the clean mud directly into the tank, discharging the undesired cuttings on the outside at the end. In this tank, mud flow is directed the length of the tank to a suction compartment at the opposite end, and thence through a return channel back to a bottom outlet at the receiving end, and thence through a connecting line to the second, or main suction tank.

Mud-pump suction is taken from a single 10¾-in. line extending directly from the tanks in a loop around to the back of the rig. This line leads directly from a connection at the outlet of the main suction tank but also has a branch feeder from the suction compartment of the mud-return tank. Gate valves are installed in the line at the outlet of each tank so that mud may be taken from either or both tanks. At the back of the rig, the line branches to the suction of both triplex pumps. Gate valves also are installed in these branches so that either or both pumps can take suction from the system. Both the triplex pumps and the duplex mixing pump have suction connections with a smaller line from an earthen reserve mud pit, making available an adequate supply of mud for any emergency.

Mud tanks are equipped with Patterson-Ballagh mud guns for mixing mud. On hand also is a Verron-Corwin desander. For storage and protection of mud materials a 16 by 18-ft. Langdon gable-type steel mud house is used. Two Turbolite-Lacy bug fans are kept on the rig floor for comfort of the crews.

The rig is highly instrumentized. Main instruments, including a Martin-Decker weight indicator and weight-indicating gage and the various drilling-control indicators and gages are located on a central panel in convenient view of the driller. Recording instruments are also provided.

Lighting fixtures, motor wiring, and switches, supplied by Branch-Krachy, are of explosion-proof construction.

Rig equipment includes a Halliburton engine-driven measuring line assembly, and a Totco surveying instrument. Kerr quick-opening valves are employed.

Edmund A. Cunningham, a graduate of U. S. Naval Academy and Harvard School of Business, who recently returned to Shell Oil Co., Inc., from war service in which he held the rank of commander, has been appointed manager of Shell's public relations office with headquarters in San Francisco.

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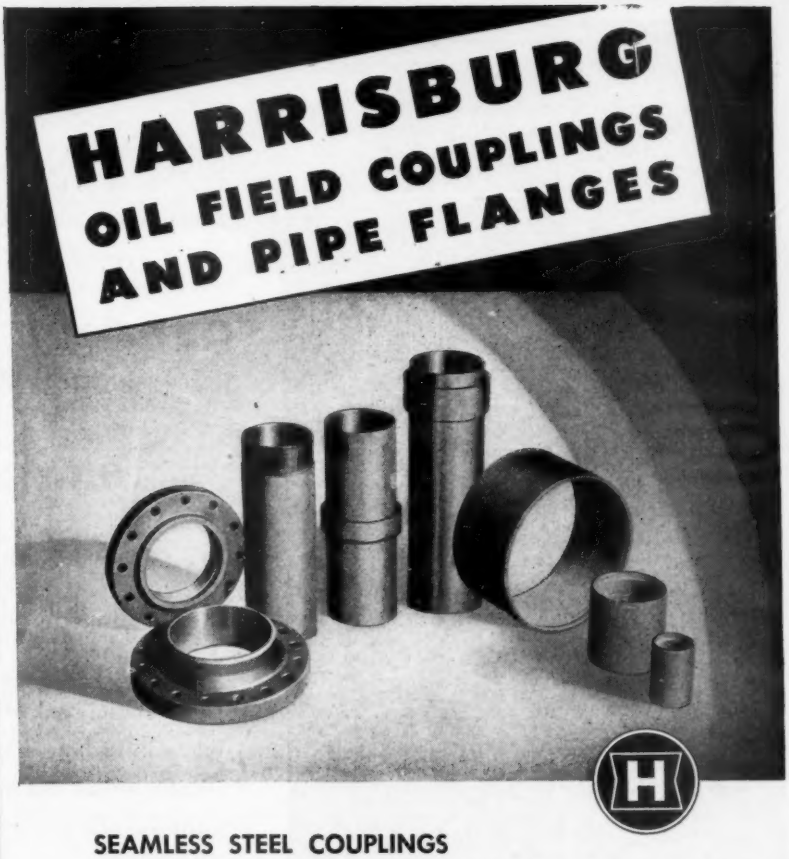

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The Reserve for Displacement of Oil By Water at Declining Pressures

*by Park J. Jones**

PART 8 OF A SERIES

THE initial reserve for displacement of oil by water at declining pressures may increase with free gas saturation up to about 10 per cent of porosity. On the other hand, a decline in reservoir pressure is accompanied by a decrease of well-producing capacity. Consequently, if wells are produced at capacity, the increase in recovery from some reservoirs may not offset the increase of investment necessitated by the declined well producing capacity. But, if per-well producing rates are limited to, say, 20 per cent of their initial producing capacity; it may be advantageous to decline reservoir pressure down to a value at which enough solution gas evolves to occupy about 10 per cent of porosity provided the resulting rate of water advancement does not exceed about 200 ft. per year parallel to bedding. The possible variations of initial reserve for displacement of oil by water at declined pressures are reviewed in this article.

Oil Recovery From a Section

THE oil recovery U_s from a section in a reservoir is defined by

$$U_s = \frac{W - I}{1 - I} \qquad (1)$$

where

W = total water saturation, per cent of porosity
I = interstitial water saturation, per cent of porosity
U_s = oil recovery, fraction of the oil initially in place.

Equation 1 defines oil recovery from a section relative to no free gas. The equation does not define oil recovery if free gas is present initially or at any time after a section is invaded by water.

However, a given section of pay will not continue producing oil without water. An increase in total water saturation for a section is accompanied by an increase of the per cent cut in the production from the section.[1,2] The composition of the production from a section as to water and oil depends on interstitial water, volume factor for reservoir liquid, and the ratio of viscosities of reservoir liquid to that of water.

*Production consultant, Houston.

The curves in Figs. 8-1 and 8-2 are illustrative examples. Oil recovery is plotted against per cent water in the production from a section. Oil recovery is in per cent of the oil initially in place relative to no free gas. Five curves are included. These correspond to fluid factors ranging from one up to 16.

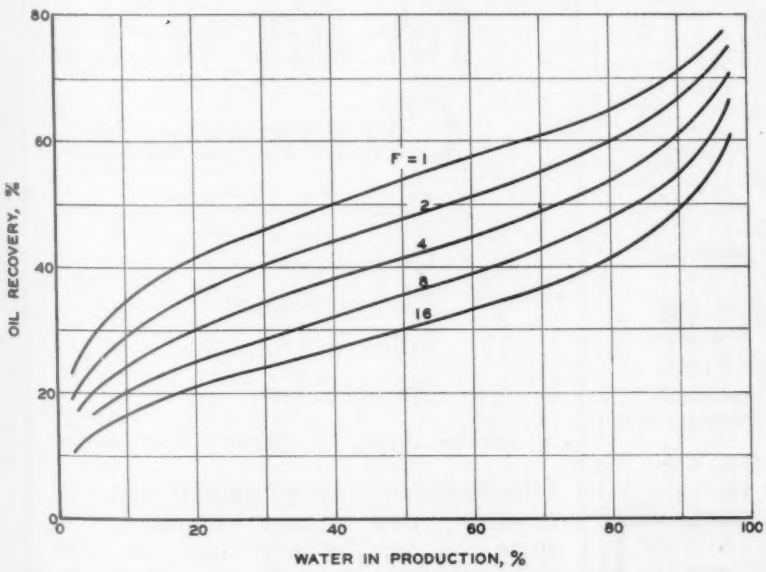

Fig. 8-1—Oil recovery by water displacement from a section of pay vs. per cent water in the production from the section; data are for 10 per cent interstitial water; F is ratio of viscosities times volume factor

The fluid factor F is defined by

$$F = \frac{b\mu_L}{\mu_w} \qquad (2)$$

where

b = volume factor for oil, barrels of space per barrel of oil
μ_L = viscosity of reservoir liquid, centipoises
μ_w = viscosity of water, centipoises.

Breakthrough Oil Recovery From A Section

The oil recovery from a section at the time water first invades a section is called the breakthrough recovery. This is the lower limit of oil recovery from any section relative to no decline of reservoir pressure below the saturation pressure for oil. Let breakthrough oil recovery be defined by approximately 5 per cent water in the production from a section of pay. Studies of data like those shown in Figs. 8-1 and 8-2 for the range of conditions found in the field indicate that the lower limit of oil displacement U_1 from a section, the breakthrough oil recovery, is defined approximately by

$$U_1 = 28 - F \qquad (3)$$

where U_1 is in per cent of the oil initially in place and F is the fluid factor defined by Equation 2. For example, the breakthrough oil recovery relative to F = 4 would be 24 per cent of the oil initially in

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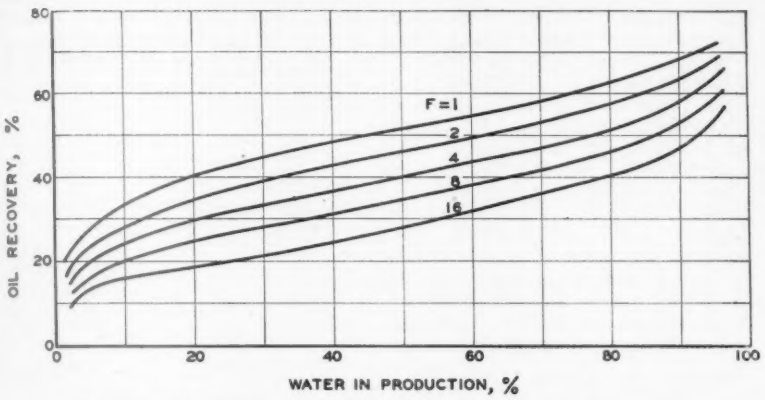


Fig. 8-2—Oil recovery by water displacement from a section of pay vs. per cent water in the production from the section for 40 per cent interstitial water; F is ratio of viscosities times volume factor

place. The breakthrough oil recovery from sections in reservoirs containing a reservoir liquid which is viscous relative to the viscosity of water may be considerably less. For example, if the fluid factor were equal to 13, the breakthrough oil recovery would be about 15 per cent of the oil initially in place. The breakthrough oil recoveries defined by Equation 3 are not necessarily exact for some types of pay. Nevertheless, we feel that the breakthrough recoveries defined by Equation 3 are accurate enough for estimating optimum rates of production. The equation is relative to no free gas.

Maximum Oil Recovery From A Section

The maximum oil recovery from a section depends on the volume of water forced through the section and on the rate of forcing water through that section. The rate at which water is forced through a given section at a given time depends on pressure gradients. Other things equal, the higher the pressure gradient acting on water the higher the velocity of water. But pressure gradients in reservoirs are always limited except in the vicinity of well bores. If we force water into a section of pay, it will produce oil along with water but not indefinitely. After sufficient water is forced through a section, oil production from the section stops. Some oil remains in the section indefinitely relative to the water velocities found in the field. Studies of data like those shown in Figs. 8-1 and 8-2 for the range of conditions found in the field indicate that the maximum oil recovery U_o by water displacement from a section is defined approximately by

$$U_o = 80 - F \qquad (4)$$

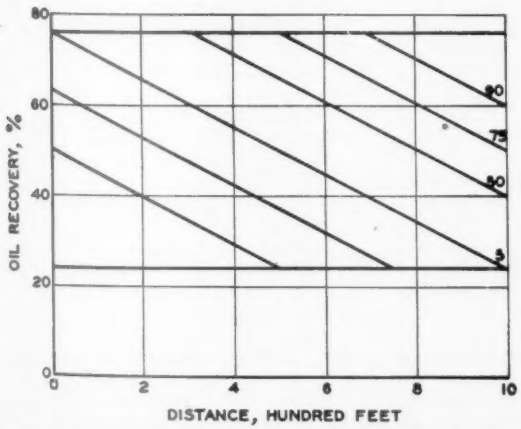
where U_o is in per cent of the oil initially in place and F is the fluid factor defined by Equation 2. For example, if F were equal to four, the maximum oil recovery from any section in a reservoir would not be likely to exceed 76 per cent of the oil initially in place. Equation 4 is relative to no free gas.

Oil Recovery From Reservoirs

As progressively higher per cent cuts are required in order to increase the oil recovery from a given section of pay, oil recovery from reservoirs relative to a fixed per cent in the production from reservoirs depends on the distance water can be displaced before reaching producing wells. In addition, oil recovery relative to a fixed per cent cut and a fixed distance depends on the acre-feet of oil pay invaded by water.

The data in Figs. 8-3 and 8-4 are illustrative examples. The lines in Fig. 8-3 are for a linear system in which there is neither areal nor sectional convergence or divergence. Oil and water are displaced through uniform cross-sectional areas. Studies of oil recoveries from various types of reservoirs indicate that the distance between the sections of breakthrough and maximum oil recovery is on the order of 1,000 ft. relative to no convergence of reserve.

The data in Fig. 8-3 are for a fluid factor equal to four. The lower horizontal line represents a 24 per cent breakthrough recovery. The upper horizontal line shows the 76 per cent maximum recovery defined by Equation 4. Water encroaches from left to right. At the time 5 per cent water first appears in the production from the section at 1,000 ft. the recovery from the section at zero has reached a maximum, namely 76 per cent. As more water is forced through the section at zero, the position of the section of maximum recovery advances and the per cent cut in the production from the section at 1,000 ft. increases. The increase in the per cent cut is indicated by the numbers in Fig. 8-3. The per cent cut corresponding to a given recovery from a section may be estimated from data like those shown in Figs. 8-1 and 8-2.



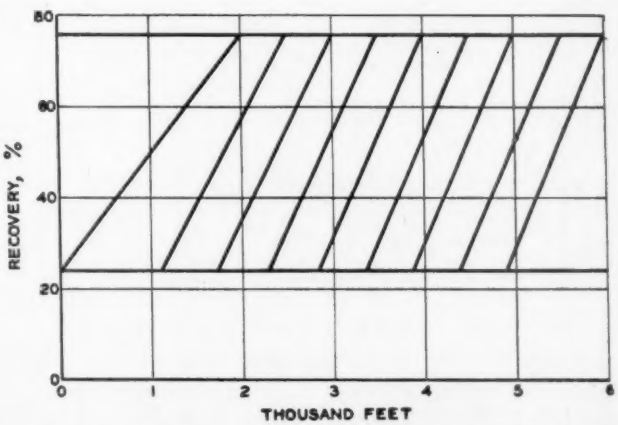


Fig. 8-3—(Left) Illustrating oil recovery by water displacement in a reservoir having no areal or sectional convergence; fluid factor is four; oil recovery in per cent of the oil initially in place; water advances from left to right; numbers represent per cent cut in the production from the 1,000-ft. section. Fig. 8-4—(Right) Illustrating oil recovery in a radial reservoir having no sectional convergence; oil recovery in per cent of the oil initially in place; fluid factor is four; water advances from right to left

XUM

The lines in Fig. 8-4 are for a radial reservoir having no sectional convergence. The indicated convergence is entirely areal. The data are for a fluid factor equal to four. Water encroaches from right to left. The lower horizontal line represents a 24 per cent breakthrough recovery. The upper horizontal line corresponds to a 76 per cent maximum oil recovery. As an oil-water interface advances toward the center of a radial reservoir, the distance increases between the sections of breakthrough and maximum oil recoveries. Studies of oil recoveries from various types of reservoirs indicate that the upper limit of the distance under consideration for areal convergence alone is on the order of 2,000 ft. This point is illustrated by the first sloping line at the left end of Fig. 8-4. The position M of the section of maximum recovery relative to B the position of the oil-water interface may be obtained from

$$B = (M^2 - 2000M)^{0.5} \qquad (5)$$

where B and M are expressed in feet. Equation 5 is limited to radial reservoirs having no sectional convergence or divergence. Variations of pay thickness should be superimposed on Equation 5.

From the viewpoint of the optimum rate of production, the effect of the distances from the source of water to producing wells on the area invaded by water is significant. The source of water is either the initial position of an oil-water contact or water injection wells if these be located within productive limits. Let J equal the ratio of acre-feet of pay invaded by water to the total acre-feet. Let D equal the ratio of the oil displaced from the region invaded by water to the oil initially in place. Then the initial reserve U, which is the ultimate recovery from a reservoir, is given[3] by

$$U = \frac{S}{b}(DJ) \qquad (6)$$

where S is the barrels of reservoir space initially occupied by oil and b is the volume factor in barrels of space per barrel of oil at initial reservoir conditions. Equation 6 states that the initial oil reserve is equal to the product of three factors; namely, S/b, the oil initially in place; J, the fraction of reservoir space invaded by water and D, the fraction of the oil displaced from the region invaded by water. It can be shown that the region invaded by water varies approximately as the square of the distance from the source of water to producing wells.

Reserve for Declined Pressure

Let U_1 be the initial reserve for displacement of oil by water relative to no free gas. Then, see Equation 1, U_1 is defined by

$$U_1 = \frac{W - I}{1 - I} \qquad (7)$$

where W is the total water saturation and I, the interstitial water saturation. W and I are expressed as a fraction of porosity. The initial reserve U_1 is expressed as a fraction of the oil initially in place.

Consider next the production of oil by evolved solution gas at declining reservoir pressure. Let the pressure decline from some initial value P_i at, or above, the saturation pressure for oil down to a pressure P. Let the free gas saturation at the pressure P be on the order of 10 per cent of porosity. Gas-oil-ratio studies for the oil produced from various types of reservoirs indicate that evolved solution gas is not producible until free gas saturation increases up to about 10 per cent of porosity.

Let b_i be the volume factor for oil at the pressure P_i and b, the corresponding value at the pressure P. Let U denote the initial reserve for oil displacement relative to 10 per cent free gas saturation. The oil not produced is equal to (1 — U). The space occupied by the oil not produced is defined by $(1 - U)(1 - I)b/b_i$. But the space occupied by the oil not produced is equal to the space not occupied by water and free gas. Accordingly,

$$1 - W - 0.1 = (1 - U)(1 - I)b/b_i$$

where 0.1 is free gas saturation expressed as a fraction of porosity. Upon solving the foregoing expression for U, we obtain

$$U = 1 - \frac{b_i}{b}\left(\frac{0.9 - W}{1 - I}\right) \qquad (8)$$

Upon substituting $(W - I)/U_1$ from Equation 7 for (1 — I) in Equation 8, we obtain.

$$U = 1 - \frac{b_i U_1}{b}\left(\frac{0.9 - W}{W - I}\right) \qquad (9)$$

Equation 9 defines U the ultimate oil recovery by water displacement relative to 100 per cent free gas saturation in terms of U_1 the ultimate oil recovery relative to no free gas saturation and the ratio b_i/b of initial to final volume factors. The value of this ratio for most oil reservoirs falls within the limits of 1.0 and 1.1.

The lines in Fig. 8-5 are solutions of Equation 9 for the ratio of volume factors b_i/b equal to 1.05. Ultimate oil recovery by water displacement relative to 10 per cent free gas is plotted against ultimate oil recovery by water displacement relative to no free gas. If the ultimate oil recovery by water displacement for reservoir pressure equal to, or greater than, the saturation pressure for oil were some value on the horizontal axis, the corresponding oil recovery relative to 10 per cent free gas would be some value defined by the solid lines. These lines give the maximum oil recovery. A decline of reservoir pressure below values for which the volume of evolved solution gas is more than 10 per cent of porosity would result in a loss of reserve relative to the reserve defined by the solid lines.

If an oil pay contains more than 40 per cent interstitial water, it also may contain some free gas initially. If the initial free gas content were 10 per cent of porosity, oil recovery would fall below the dashed line in Fig. 8-5. This dashed line shows the maximum oil recovery relative to 10 per cent initial free gas saturation and no decline of reservoir pressure. Relative to a 10 per cent initial free gas saturation, a decline of reservoir pressure would be accompanied by a loss of initial reserve. The limiting condition for free gas saturation in media containing oil is silt or siltstone. These media may contain, for example, 65 per cent water, 20 per cent oil and

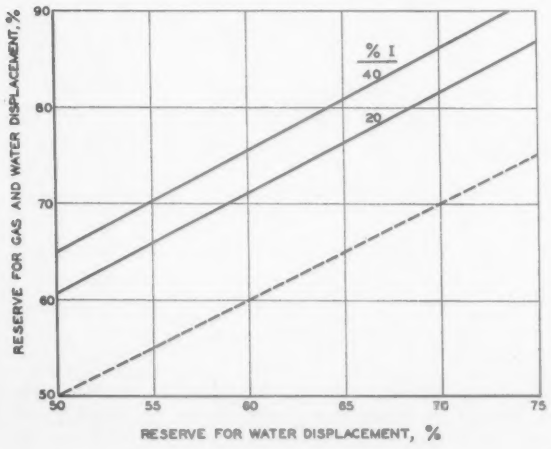


Fig. 8-5 — Reserve for displacement of oil by gas and water vs. the reserve for displacement by water only; reserve is in per cent of the oil initially in place; I is interstitial water in per cent of porosity; dashed line shows maximum oil recovery for 10 per cent initial free gas saturation; ratio of volume factors b_i/b is 1.05

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CAUSE THIS
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CAN COST LIVES
LOOSE TALK
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LOOSE TALK
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QUIET!
LOOSE TALK
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The veil of secrecy which, of necessity, has shrouded the operations of war plants, has now been lifted and we can tell you much about the little known facts that have brought high honors to our company and to the oil industry with which we are so proudly identified.

AT THE CLOSE OF HOSTILITIES, only eight war plants* in the entire nation were permitted to fly the United States Navy Bureau of Ordnance Flag and the All-Navy "E" Burgee with six white stars affixed—each star indicative of a renewal of the first "E" award made in World War II. The original "E" award was made in July, 1941.

The men and women of Cameron Iron Works, whose outstanding record of Naval ordnance production made it possible for their company to retain membership in this distinguished group of American industrial plants, are justly proud of this signal honor.

On the following pages are listed production figures on each item of Naval ordnance materiel produced in the five Cameron war plants. Along with these huge quantities of war goods, Cameron engineers found time to develop and perfect the new sensational type "QRC" blowout preventer and type "GP" valve while producing unprecedented quantities of oil field equipment.

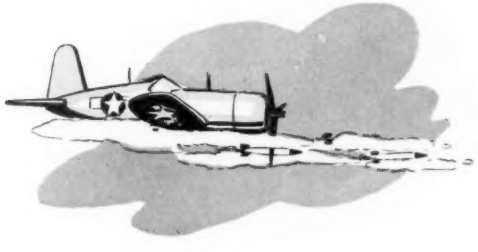
---

* *Arma Corporation, Brooklyn, N. Y.*
Cameron Iron Works, Inc., Houston, Texas
Ford Instrument Co., Inc., Long Island City, N. Y.
General Motors Corp., Fisher Body Div., Die & Machine Unit, Detroit, Mich.
Keuffel & Esser Co., Hoboken, N. J.
The Midvale Co., Nicetown, Philadelphia, Pa.
Miehle Printing Press & Manufacturing Co., Chicago, Ill.
Northern Ordnance, Inc., Minneapolis, Minn.

ITEM	NUMBER PRODUCED
Type "K" Depth Charge Projectors (Navy's entire requirement)	14,826
Arbors for Depth Charge Projectors	313,050
Breech Mechanism Covers for Depth Charge Projectors	15,667

ITEM	NUMBER PRODUCED
Hydraulic Mounts for 20mm Guns	2,298

ITEM	NUMBER PRODUCED
Yokes for 4-Inch Guns	438



ITEM	NUMBER PRODUCED
Rockets	(Production figure confidential but 13 million dollar contract is now nearing completion.)

ITEM	NUMBER PRODUCED
Signal Flare Projectors	2,642

ITEM	NUMBER PRODUCED
3-Inch Barrels for 50 Calibre Guns	2,585

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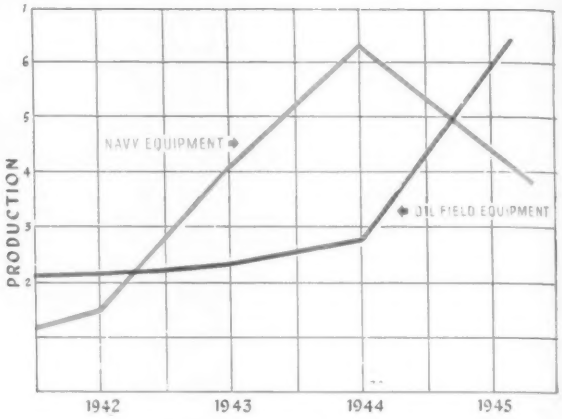
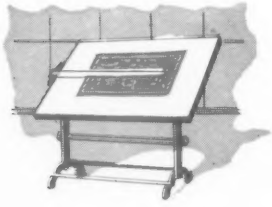
ITEM	NUMBER PRODUCED
Roller-Turner Attachments for War Plant Turret Lathes	2,739

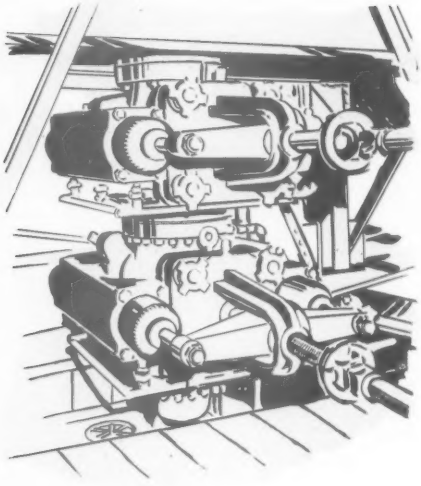


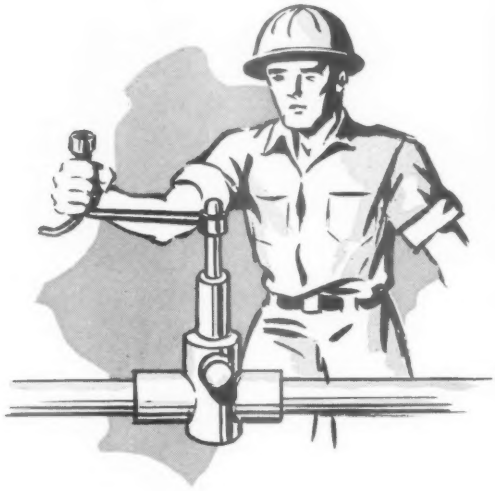
From June, 1941, to June, 1945, Cameron's production of oil field equipment soared to unprecedented heights as PAW requests for new wells increased from year to year. The above graph clearly reflects this increase as well as the rapid and simultaneous rise in the production of naval equipment.



EXPERIMENTAL CONTRACT

Cameron Iron Works enjoys the distinction of being one of the very few independent industrial plants in the country with whom the U. S. Navy, Bureau of Ordnance, maintains an experimental contract.





"WAR BABIES" WITH A PEACETIME FUTURE

The new Cameron Type "QRC" (Quick Ram Change) Pressure Operated Blowout Preventer is superior to all previous Cameron drilling control units. It was conceived, developed and supplied in substantial quantities long before "VE" day, despite extremely heavy demands for naval ordnance materiel. The "GP" (Gate-Plug) Valve, like the "QRC" Blowout Preventer, was in production many months ago, employing an entirely new and more efficient design. Plans are now under way for mass production of the "GP" Valve.

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15 per cent gas. Upon reduction of reservoir pressure, these media would produce gas and possibly some water but no oil. However, the GPM content would be high.

The data in Fig. 8-5 are not intended as a procedure for estimating initial reserves. Initial reserves depend on several other factors not considered above. The data merely illustrate the possible variation of initial reserve relative to declined pressure.

Well-Producing Capacity vs. Declined Reservoir Pressure

From the viewpoint of optimum producing rates, the size of an initial reserve is but one factor. We also should consider the effect of declined pressure on well-producing capacity and on operating expenses. A decline of well-producing capacity would necessitate an investment which would be inversely proportional to well-producing capacity if the rate of production from a reservoir is to be maintained with wells produced at capacity. On the other hand, if the per well rate of production were restricted to, say, 20 per cent of the per well producing capacity at initial reservoir pressure, the rate of production from a reservoir might be maintained even if reservoir pressure were declined until 10 per cent of porosity were occupied by free gas.

Reservoir Pressure vs. Rate of Water Encroachment

Reservoirs in which oil is displaced by water have a maximum efficient rate, or MER. The upper limit for this MER is on the order of 200 ft. per year parallel to bedding. If the MER were to be exceeded upon declining reservoir pressure until 10 per cent of porosity is occupied by evolved solution gas, a loss of reserve could result from (1) bypassing of oil by water; (2) unequal rates of interface advancement, and (3) fingering into wells. On the other hand, if the rate of water encroachment at the pressure corresponding to 10 per cent free gas saturation were less than both the MER and the optimum rate of production, additional decline of reservoir pressure would result in a loss of reserve relative to the pressure at 10 per cent free gas saturation. A decrease in the size of the initial reserve would reduce the optimum rate of production proportionally to the reserve. An increase of operating expenses caused by declined pressures, also tends to reduce the optimum rate of production.

The factors considered in this article do not include all the variables inherent in producing oil at declining pressures. Still other variables will be considered in the next article.

References

1. The Oil and Gas Journal, March 17, 1945, p. 107.
2. The Oil and Gas Journal, March 24, 1945, p. 71.
3. The Oil and Gas Journal, November 4, 1944, p. 53.

D. P. Bailey, formerly general superintendent of The Texas Co.'s refinery at Port Arthur, Tex., has been made assistant works manager. He is succeeded as general superintendent by **F. H. Holmes,** formerly superintendent of Texaco's refinery at Lockport, Ill. **F. L. Wallace** remains works manager at Port Arthur. **L. V. Phillips,** superintendent at the Lawrenceville, Ill., refinery for the past 2 years, was transferred to Lockport to take the post vacated by Holmes. Phillips' former position at Lawrenceville has been filled by **F. M. Dawson,** until recently a refinery superintendent in Argentina. Holmes, Bailey, and Dawson joined Texaco in 1927, Phillips in 1923.

J. C. Gilbert, manager of the Santa Monica, Calif., district of Southern Counties Gas Co., has been elected a director to fill the vacancy created by the recent death of Ferdinand R. Rain.

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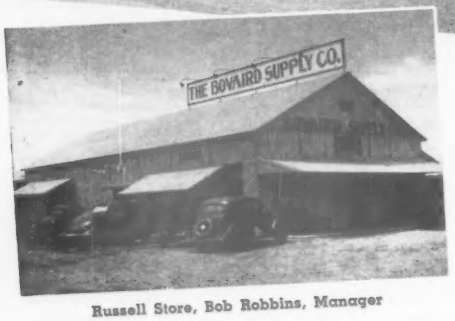
Chase Store, Raymond Batcheler, Mgr. & Asst. Dist. Mgr.

McPherson Store, Dale Osmer, Manager



Russell Store, Bob Robbins, Manager

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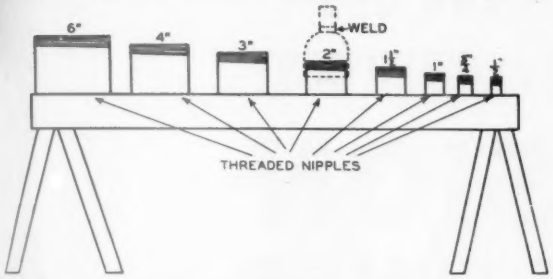
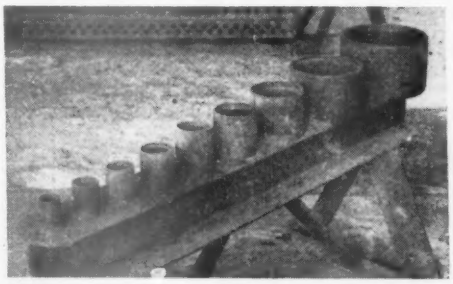
Plant Practices

Holder for Making Swedges

FOR the construction of reducing nipples, etc., a refienry staff developed the holder shown in the accompanying drawing. The holder is made of a 6-in. I-beam as the main horizontal member, with two-channel-iron or other type steel legs at each end, welded on; these legs may be braced with a horizontal tierod of steel strap or other scrap metal if desired.

Atop the I-beam which is set with the web in a vertical plane, are welded short (3-in. to 8-in) threaded

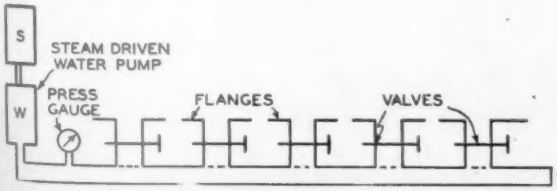


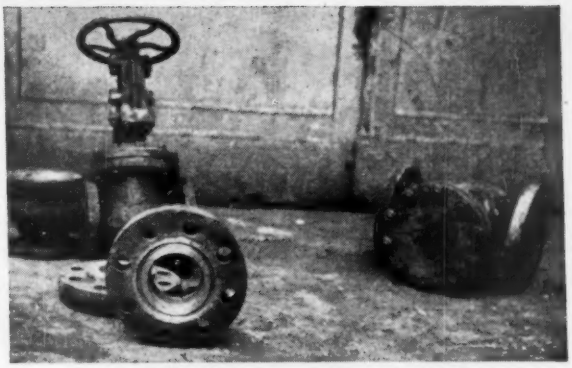


nipples, chosen to fit the larger ends of the various reducing nipples to be made, with 4-in. to 6-in. spacings between nipples. These may be threaded either internally or externally or both, as desired, though threading double seriously weakens ordinary weight nipples. In use, the larger section of the reducer is screwed onto the holder nipple; this section is generally that which has been swaged down on one end to the approximate diameter of the smaller section. The smaller section then is placed above the larger, with beveled edges adjacent, tack-welded into position, and the welder may then complete the welding of the seam, with the work held rigidly at a level convenient for rapid, efficient work.

Valve-Testing Assembly

FOR testing rebuilt valves such as those shown in the photograph, the arrangement shown in the drawing is used. The steam pump can give 2,000 psi. with a 14-in. steam piston, using high-pressure steam; the





pump is about 2½-in. bore and 12-in. stroke. The manifold is fitted with flanges for four valve sizes: 4-in., Series 900; 4-in., Series 1500; 3-in., Series 300, and 4-in., Series 300. Valves are inserted in the risers to these flanges, in order to cut out any outlet not being used at any given test. Adapters may be fitted to these primary flanges to accommodate any size of valve. Testing is generally limited on this assembly to 1,500 lb. maximum.

Pipe-Bending Platform

THE photograph shows a simple perforated heavy platform imbedded in concrete for making simple bends in heavy pipe. The sector of a short cylinder is made to any desired radius, or several may be made to different radii if desired. A heavy section of pipe,

such as 2-in. or 3-in., is dropped through a hole near one end of this sector and into one of the platform holes. A section piece of pipe drops into an adjacent hole to support the other end of the curve but allow the latter to be rotated around the first support if desired. The pipe to be bent is heated throughout a desired length, placed on the platform and bent to the desired degree, placing levers or bars in the holes in the platform to force the hot pipe into shape. A small pipe is shown in position for bending; small pipe generally does not require heating.

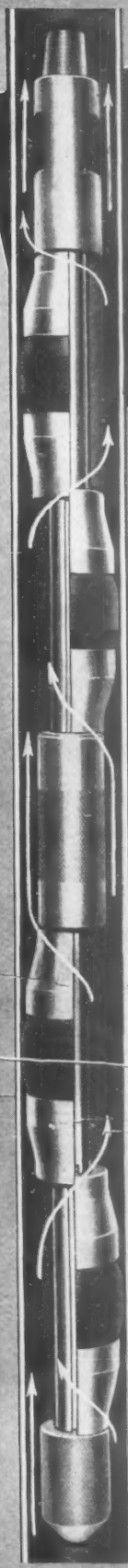
Systematic Storing of Gaskets and Fittings

A SYSTEMATIC method for storing gaskets and other small fittings and replacements of equipment such as heat exchangers has been devised. A series of racks has been built, being open, slatted compartments. On the front strap of each is placed a card on which the exact designation of its contents is placed. All exchangers in the refinery, for example, are numbered and coded. For instance the code letter "C" refers to exchangers, "A" to the alkylation unit, the code "CA" refers to the exchangers at the alkylation unit, and "CA-18" refers to exchanger No. 18 at that unit, which exchanger is numbered in accordance with the code. An illustrative compartment card is

CP - 3 - Feed Splitter Exchanger on reboiler (Polymerization Unit).

Item 61 — Tab Ring
Item 62 — Partition
Item 63 — Ring
(etc.)

These ideas are used in the Cleveland and Toledo refineries of Standard Oil Co. of Ohio



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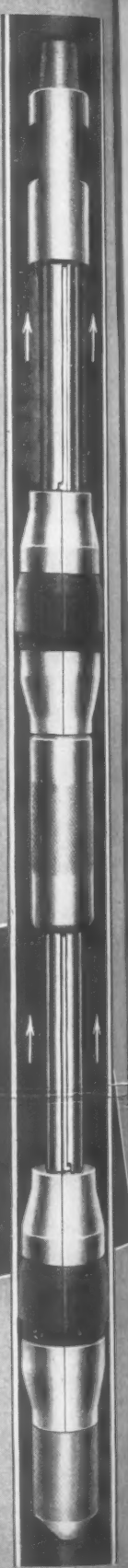

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A.I.M.E. ABSTRACTS

The accompanying abstracts are of papers presented at Houston and Fort Worth, which were not previously presented in Tulsa. The Tulsa papers were abstracted in last week's Journal

A New Technique for Determining the Porosity Of Drill Cuttings

M. A. WESTBROOK and J. F. REDMOND, Shell Oil Co., Inc., Houston.

THIS paper describes a technique by which the porosity of a formation can be determined with reasonable accuracy, from drill cuttings, eliminating the necessity for expensive coring. It can be used with either limestone or sandstone cuttings, and results check favorably when cores are examined in the conventional manner, then crushed and examined by the new technique.

Although coring expense is eliminated, the results are reliable only when the cuttings obtained are accurately correlated with the interval drilled. Therefore, special precautions are often required when drilling and sampling. Sometimes it is necessary to drill small intervals, and circulate cuttings to the surface before drilling the next interval. Reverse circulating methods have also been used to advantage to recover cuttings.

The method consists of washing cuttings through a No. 6 gage screen, separating shale and other extraneous particles, until 10-15 cc. of sample are obtained. This is extracted and dried by the same methods used for preparing core samples for porosity measurements. The clean, dry cuttings are weighed, placed in a weighed and volumetrically calibrated graduate, evacuated for 20 minutes, then saturated with water. Then water is added until the graduate is filled to the calibration mark, after which it is reweighed and water weight determined, then converted to water volume. The resultant water volume subtracted from the calibrated volume equals dry grain volume.

The saturated cuttings are then spread on a porous diaphragm (an alundum disk is satisfactory) which is saturated and in contact with a column of water whose hydrostatic head can be lowered. Lowering the head applies suction to the cuttings, removing excess water, and leaves the cuttings completely saturated. The bulk volume is then obtained by transferring the saturated cuttings to a graduate containing sufficient water to cover the sample, and determining the volume of water displaced. This is equal to the bulk volume.

The porosity percentage then equals bulk volume less grain volume, divided by bulk volume, multiplied by 100.

Some Recent Developments in Mud Analysis Logging

B. OTTO PIXLER, Baroid Sales Division, National Lead Co.

THROUGH appreciation of the various factors which influence mud-analysis results, a better understanding of the science is being made possible and more reliable interpretations of the results obtained. This, in turn, is leading to extension of the use and value of the method for the determination of oil and gas content of reservoirs.

Factors affecting the interpretation of mud-analysis logs are: rate of penetration in drilling, mud properties, coring procedure, and reservoir characteristics as related to the "flushing effect." Effects of these factors on interpretations are discussed in detail.

Where comparable data are available, better oil and gas shows are obtained in cases where low water loss muds are used. Also, the best logging results are obtained under normal drilling conditions when hole is being made as fast as possible. Relative intensities of oil and gas shows usually are reduced when coring. Usual fluid reservoir pressures provide good logging conditions when formations are drilled at rates limited only by the drilling equipment and the hardness of the reservoir rock. Unusually high or low fluid reservoir pressure affect the interpretation of the mud-analysis log in that under some circumstances the intensities of oil and gas shows may not be indicative of the actual reservoir fluid content. Under normal drilling conditions, the effect of flushing action on the log is not critical. However, there are unusual conditions under which the showings of oil and gas are reduced appreciably by flushing action.

In its present state of development, mud-analysis logging does not give quantitative results as to the amount of oil and gas occurring in a formation; nor does it furnish quantitative information on the productivity of the oil and gas horizons. It does give reliable qualitative information on the occurrence of oil and gas.

Recent improvements in the gas-detector instrument provide a means of changing the temperature of the detector filament. At normal operating temperature, the instrument indicates the total combustible gas in the air-gas mixture being tested. At a lower temperature, it indicates only the higher-molecular-weight hydrocarbons. The difference between the two readings indicates the presence of methane. The significance of the relationship existing between the two curves materially assists field interpretations. With few exceptions, zones not showing an increase of methane can be condemned.

Performance of Distillate Reservoirs in Gas Cycling

W. HURST and A. F. VAN EVERDINGEN, Shell Oil Co., Inc., Houston.

DISTILLATE bearing pools are often made up of sand stringers of different permeabilities which in total constitute complex reservoirs. To account for the influence of the different permeabilities "parallel flow" is defined and this concept used to compute the recovery efficiency of recycling such a sand complex. Each permeable section which can be traced over a structure is considered as a unit in a parallel arrangement of the sand layers. It is assumed that the potential distribution in each parallel section is the same.

The paper is divided into two parts: (1) the gas-injection wells form a line-source (one complete side of a rectangle) and the producers a line sink (the entire opposite side of the rectangle); (2) a gas-input well is taken as a point source and the producer as a point sink thereby introducing the influence of the position of the wells as such in the recovery efficiency of the unit. For the first case an illustrated computation is made where 17 sand layers are involved.

Computations for the second case are detailed. Formulas are given from which to obtain the pressure and streamlines in a steady state flow. A method is devised to compute rapidly the successive positions of the dry gas front. In the event the field is of an irregular shape, pressure and streamlines can be obtained by a potentiometric electrical model study.

Using the concept of "parallel flow" and the results obtained by mathematical analysis or by electrical model study for a homogeneous formation, the effects of different permeabilities and of the location of the wells can be established. From these studies it is apparent that the efficiency of recycling is profoundly influenced when differences in permeability are taken into consideration.

A Neutron Method For Measuring Saturations in Laboratory Flow Experiments

E. BRUNNER and E. S. MARDOCK, Shell Development Co., Emeryville, Calif.

A METHOD of measuring oil saturations in cores or sand packs by neutron scattering is described. This method permits local saturations to be measured in a core enclosed in a steel pressure vessel without interrupting the flow. Calibration data and a saturation distribution measurement obtained with the apparatus are included by way of illustration.

Effect of Arsenates on the Viscosity of Drilling Muds

B. C. CRAFT and C. M. MONCRIEF, Louisiana State University, Baton Rouge, La.

DURING the past 10 years the chemical content of drilling mud has become of major importance in affecting the successful drilling and workover of wells. In this work there has developed a large market for viscosity-reducing chemicals.

It is the purpose of this paper to point out the effects of arsenates in controlling the viscosity and gelling characteristics of a drilling mud.

From the periodic table it may be seen that members of the arsenate group include arsenic, antimony, and bismuth; however, this investigation was limited to arsenic.

The amounts of arsenates required to produce maximum reduction of viscosity when added as a 6 per cent solution to a 900 cc. sample of bentonite-clay mud form the basis for a table (included in this paper) which shows the effects of chemical treatment on gel strength and filtration. The conclusions of this investigation are as follows:

1. Bentonite-clay mud treated with tetrasodium pyroarsenate resulted in substantially the same reduction in viscosity and water loss as the complex phosphates.

2. The complex arsenate showed a slightly higher reversion after heating 16 hours than the complex phosphates.

3. Neither trihydrodiorthoarsenate or sodium dihydrogen orthoarsenate processes good viscosity-reducing properties.

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4. Since the arsenates are highly toxic, their use would be limited in actual practice.

Precision in Bottom-Hole-Pressure Measurement

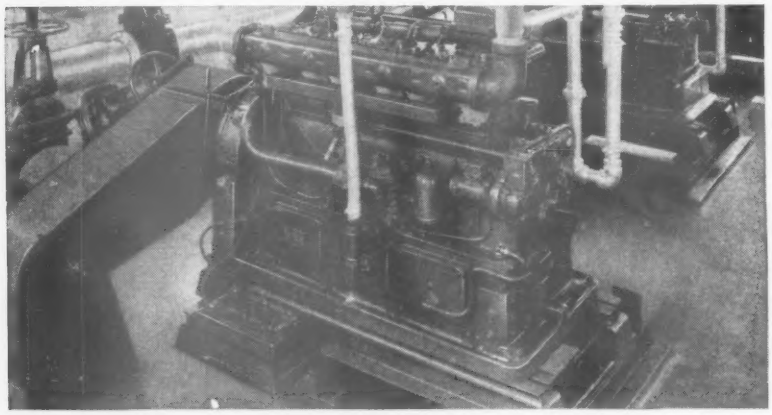
E. R. BROWNSCOMBE and D. R. CONLON, Atlantic Refining Co., Dallas.

ONE of the factors limiting engineering studies of the pressure changes in oil and gas reservoirs is the accuracy with which the reservoir pressures can be determined. This paper deals with improvements in the measurement of bottom-hole pressures which permit pressures even as high as 4,000 or 5,000 psi. to be determined with gage errors of only a plus or minus of 1 to 2 psi.

In this paper the authors present a detailed, comprehensive discussion which shows that by elimination of reading errors, by improvement in the reproducibility of the atmospheric pressure line, and finally by use of multiple tests and calibrations, the accuracy of the bottom-hole-pressure tests can be greatly improved.

In addition to these changes, a procedure, recently developed, decreases the errors in the pressure measurements by a factor of 2, and this method calls for the use of a portable calibrating bath and a portable deadweight gage so that the pressure gages can be calibrated in the field before using.

In addition to the factors shown above, which were briefed from the author's paper, several precautions to be taken in planning the survey and interpreting the results were discussed in detail.



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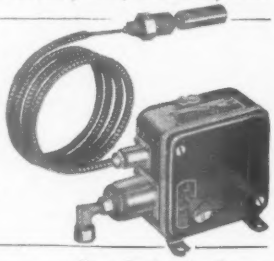
Magneto Ignition Applications. Sounds an alarm only . . . grounds single or dual magneto . . . grounds magneto and sounds an alarm or lights a signal light.

Dual Ignition Applications. Opens battery circuit and grounds magneto.



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BOOKS

PRINCIPLES OF INDUSTRIAL PROCESS CONTROL. By D. P. Eckman. John Wiley & Sons, Inc. Copyright, Brown Instrument Co. $3.50.

A strong tendency of a qualified instrument man in preparing a book for the guidance of instrument users, operators, students, etc., is to lean in the direction of instrument design, to go deeply into principles, mathematics, theory of control and of application of control to industrial operating problems. This statement may be applied mildly to this book. The book, nevertheless, undertakes a careful presentation of the majority of the fundamental principles and concepts governing control, especially automatic control. Basing explanations of control methods on the reaction rate-lag method of calculation, the author proceeds to compute controller settings; he gives numerous lags for typical processes.

Characteristic of his presentation is the inclusion of equations and calculations for the derivation of principles, constants, etc for use in control arrangements. For example, he derives the "response curve" of a temperature primary element from Newton's Law of Cooling, and from that the lag coefficient for this specific operation. In another case he spends four pages deriving equations dealing with "Dynamic Error and Lag" from principles also springing from Newton's Cooling Law. He outlines the Operation of Reset Response with careful presentation of the somewhat involved calculus steps to obtain the required values and equations. While these presentations are of questionable value to the operator in the plant they are of undoubted usefulness to the student and the instrument designer.

The author includes in his work numerous references, placed at the end of each chapter, in the literature from which additional data and details may be obtained by the inquisitive reader. He devotes whole chapters to the theory of automatic control, use of reset and of rate responses, fluid flow control, dual control agents, and electrical controls. Explanations and logical sequence of discussion are good in almost all cases; the reader not highly trained in mathematics can follow the discussions easily without the necessity for working out the mathematical derivations and can absorb satisfactorily the important ideas presented.

AUTUMN LEAVES. By P. W. Litchfield. Published by Corday & Gross, Cleveland. 125 pp.

The subtitle of this little volume is "Reflections of an Industrial Lieutenant." The author, who is chairman of the board of Goodyear Tire & Rubber Co., puts into the book a distillation of his personal and business philosophy as that has evolved in 45 years in industry. On the business side he tells what any business house must do to succeed, while on the personal side he discusses the effect of heredity, environment, and training on the individual, and outlines with ingenious charts the various productive seasons on an individual's life. The book is illustrated by Rockwell Kent.

MANUAL ON HOT-MIX ASPHALTIC CONCRETE. Published by The Asphalt Institute. 801 Second Avenue, New York. 112 pages.

This manual contains two specifications for asphaltic concrete, one termed "dense graded aggregate type" and the other "graded aggregate type." These specifications represent two different philosophies of design, and both are presented according to the foreword, in order that the engineer may select the one which best fits his requirements from the standpoint of available aggregates, climatic conditions, and equipment.

The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Fractionation for Solvents

REFINER'S Notebook No. 62 of October 6, 1945, dealt with the fractionation attained in multidraw petroleum oil towers with and without steam strippers. The same type of information is given here for solvent fractionators operating with large amounts of reflux (infinite) and large numbers of trays but the use of steam strippers is not considered and only towers that produce two products (with feed near center) are contemplated. Necessarily, the degree of fractionation indicated in Fig. 1 is only approximate because many variables such as plate efficiency, amount of reflux, design of bubble-plate, irregular feed compositions, the relative amounts of the two products, and most important of all, the delicacy of temperature control, cannot be accurately known. The method outlined in Petroleum Refinery Engineering, 2nd Ed. (McGraw-Hill Book Co., Inc., New York) and The Oil and Gas Journal (July 21, p. 41; August 4, p. 44; August 18, p. 58; September 15, p. 46; October 6, p. 56; October 20, p. 59; October 27, p. 178; November 10, p. 44; December 1, p. 40, and December 15, p. 46, all in 1938) was employed except that elaborate trial-and-error computations were undertaken to determine the proper temperature gradient in such towers. The terms used and the general method is the same as that employed in Refiner's Notebook No. 62. Towers operating from 5 to 45 psig. producing solvents in the boiling range of 100 to 450° F. are contemplated.

Gap or overlap indicates the difference in temperature between the 95 per cent A.S.T.M. temperature of the low-boiling product and the 5 per cent A.S.T.M. temperature of the high-boiling product; or less accurately, it may be applied to the e.p. of the low-boiling product and the i.b.p. of the high product (see dotted curves on Fig. 1). Use of steam strippers is uncommon on two-product towers but would improve separation.

Reflux ratio is defined as the ratio of internal or hot reflux at the top (Notebook No. 46, June 16) to the overhead product. Reflux ratios of 10 to 1 are substantially the equivalent of infinite reflux when using only 6-10 plates but a reflux ratio of about 20 to 1 is required to obtain effect of infinite reflux in towers with more than 25 plates.

Boiling range of the product or products is a vital consideration. Width of cut or fraction is defined as the difference in the 50 per cent boiling points of the products. If the two products are about equal in quantity or have same length of boiling range, width of cut is the same as boiling range of fractions.

Tower operation has been discussed in the following installments:

- **No. 56, Aug. 25, Regulation of I.B.P. & E.P.**
- **No. 57, Sept. 1, Dirty Streams**
- **No. 58, Sept. 15, Tower Hydraulics**
- **No. 60, Sept. 22, Bringing a Tower on Stream**
- **No. 62, Oct. 6, Number of Plates**
- **No. 68, Nov. 17, Maximum Tower Capacity**
- **No. 70, Dec. 1, Tower Inspection**

The current schedule of topics is:

- **No. 61, Gasoline Performance**
- **No. 62, Number of Plates**
- **No. 63, Lead Response**
- **No. 64, Solvent Fractionation**
- **No. 65, Lead Response — Desulfurized**
- **No. 66, Vessels, Manholes, & Heads**
- **No. 67, Lead Response—Cracked**
- **No. 68, Maximum Tower Capacity**
- **No. 69, Crude Exchangers**

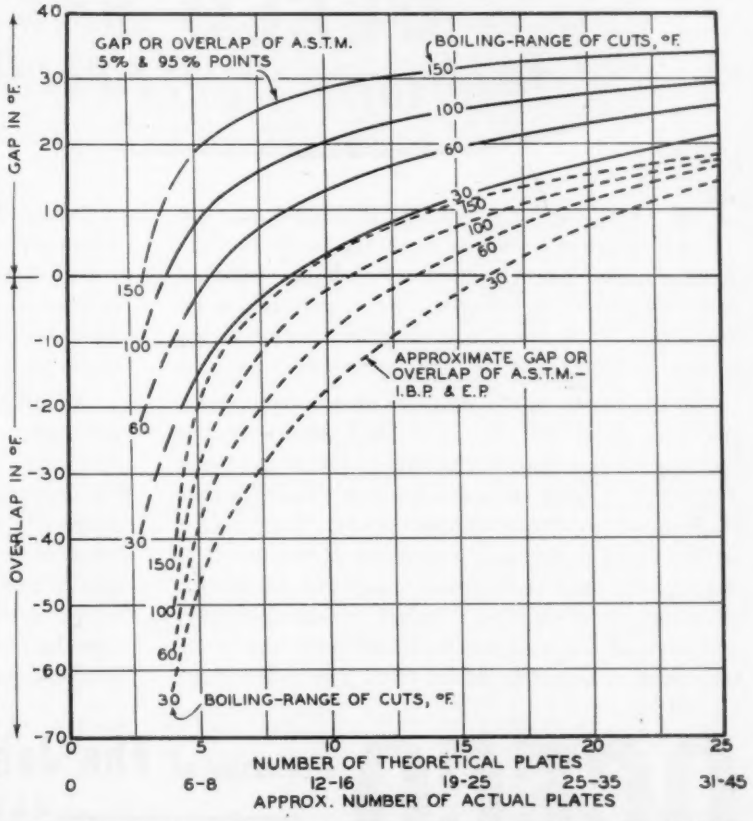
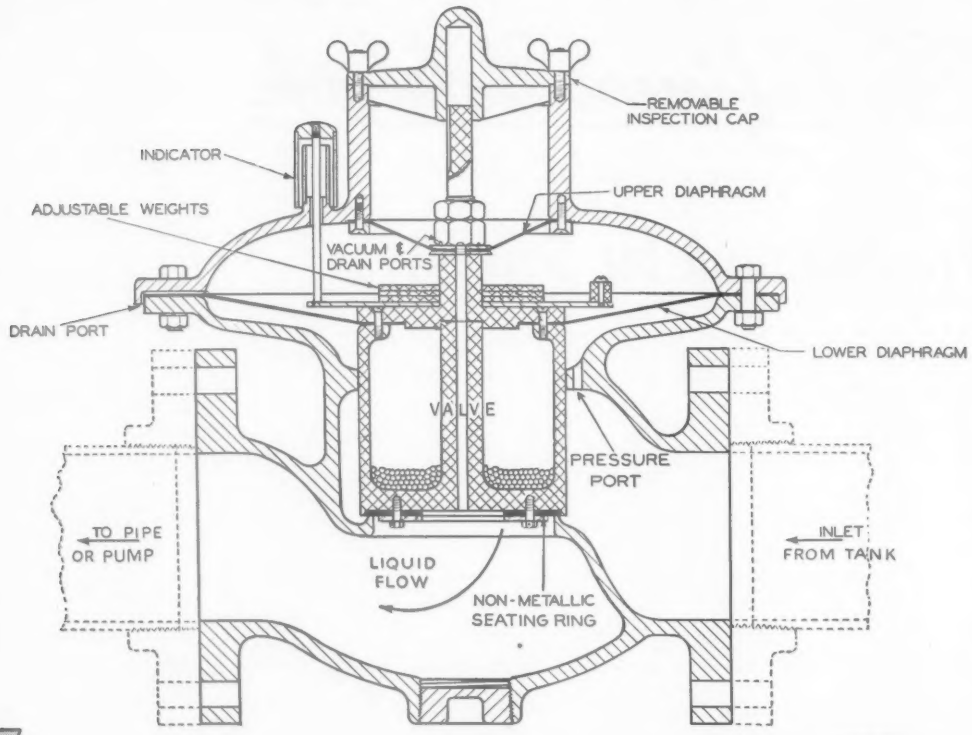


Fig. 1 — Approximate fractionation attained in heavy-oil towers which produce only two products when operating with infinite reflux (ratio of 10 or more to 1 with few plates, or about 20 or more to 1 with 25 plates)

No. 64 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa



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Engineering Fundamentals

No. 206

A FEATURE OF THE OIL AND GAS JOURNAL

The Chemistry of Acidizing

This is the second of a series of discussions on acidizing wells, which represent the assistance of several experts and engineers. The remaining parts of the series will present the technique and results of acidizing, dissolving mud sheaths, and distinguishing spent acid from formation waters.

IN the chemical laboratory, the strength of acids is expressed in terms of normality, as ½ N., N., 4 N., etc. A one normal (1 N.) acid is obtained by dissolving the gram equivalent weight of acid in sufficient water to equal 1 l. With hydrogen having an atomic weight of 1 and chlorine 35.46, thus when 36.46 g. of HCl are dissolved in water to yield a volume of 1 l., 1 normal (N.) hydrochloric acid is formed.

One-normal HCl is equal to 3.6 per cent acid, where the percentage is weight or HCl in 100 lb. of the acid solution.

Commercial acid is shipped from the manufacturers to field treating stations in concentrations of from 28 to 36 per cent strength (by weight). It must be remembered that pure or 100 per cent HCl exists as a gas, and that it is not practical to ship acid in higher concentrations than the aforementioned range.

In treating oil and gas wells an acid concentration of 15 per cent is most generally used. A chart showing the dilution which must be made to strong concentrations of HCl to obtain the strengths in the range used in treating is shown in Fig. 1.

There is a relationship between the specific gravities of HCl solutions and their precentage strength by weight which is convenient where one has need to determine quickly the percentage of acid. This relationship is shown in Fig. 2. The specific gravity of the acid to be tested can be found with a hydrometer.

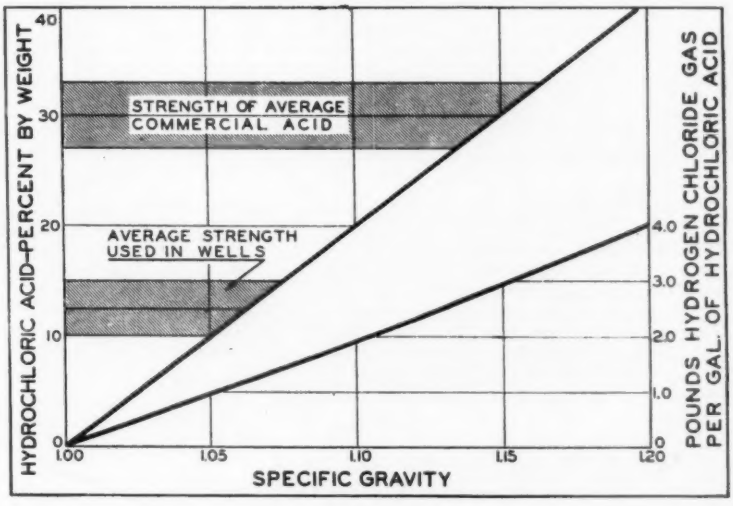

Fig. 2

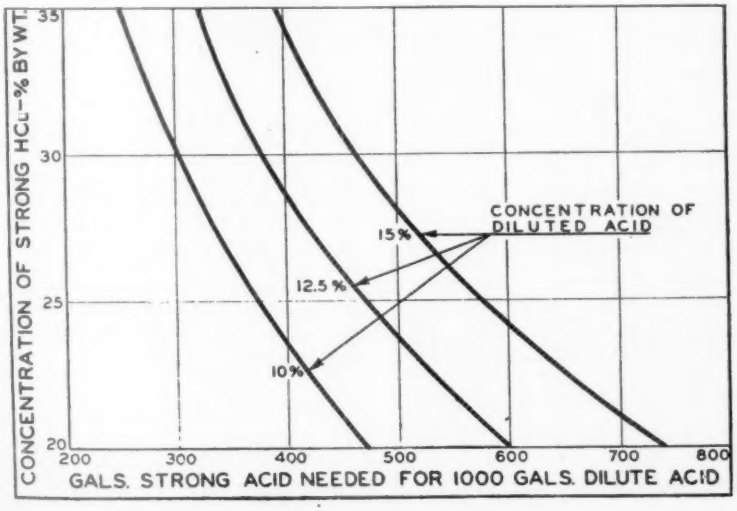

Fig. 1

Amount of Limestone Dissolved by HCl

In the previous installment (No. 205), the reaction between hydrochloric acid and limestone was given as:

$$2\,HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$$

$$73 + 100 = 111 + 18 + 44$$

where the figures given below the equation can be expressed in pounds of the compounds involved.

In 1,000 gal. of 15 per cent (specific gravity 1.075) acid there are present $1{,}000 \times 8.333 \times 1.075 \times 0.15$, or 1343.2 lb. of HCl. By proportion from the above formula, 1,343.2 lb. of HCl will react with 1,840 lb. of $CaCO_3$ to form 2,042.4 lb. of $CaCl_2$, 331.2 lb. of H_2O and 809.6 lb. of CO_2. With the average density of limestone being about 170 lb. per cu. ft., the 1,840 lb. of $CaCO_3$ dissolved by the 1,000 gal. of 15 per cent HCl equals a volume of 10.8 cu. ft. The chart in Fig. 3 has been

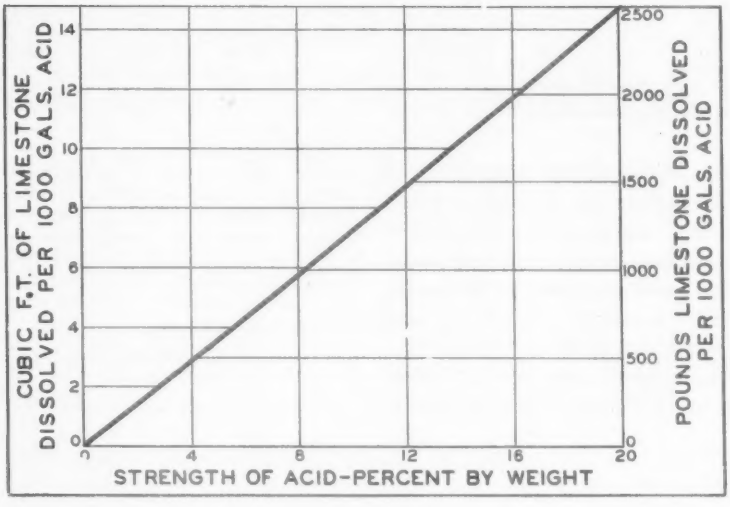

Fig. 3

constructed from a number of such calculations and is useful in obtaining either the pounds or cubic feet of limestone removed by specific acid treatments.

A factor determining the rate of reaction of HCl on calcareous formations is the temperature. The speed is about doubled by each 25° F. increase. The relationship is shown in Fig. 4. Increases in pressure, on the other hand, slow up the reaction. Experimental data at 120° F. for a range of pressures are given in Fig. 5.

Strength of Acid Used

Speeds of chemical reactions are proportional to the concentration of the reacting compounds.

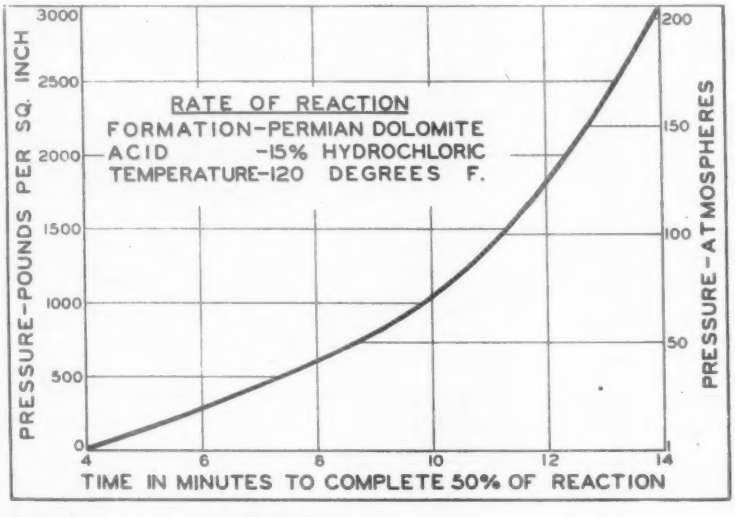

Fig. 5 (Above)

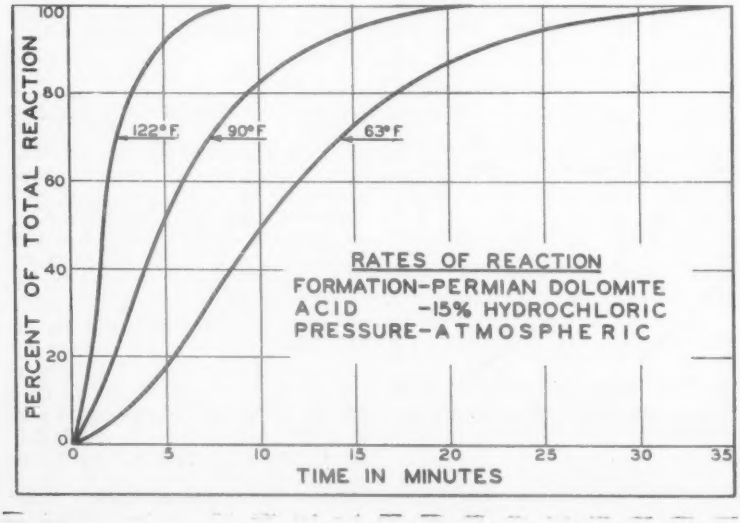

Fig. 4 (Below)

It must be remembered in the acid treating of wells that there is always an excess of limestone or dolomite available for reaction with whatever quantity of acid is used. For this reason weak acid solutions are seldom used because once they are in the formation the length of time is short before the reaction is virtually completed. On the other hand, if 15 per cent acid is used it can be pumped further back into the formation before sufficient reaction has taken place to where the concentration has substantially diminished. Furthermore, the treatment is more efficient if the acid is pumped in rapidly because that permits more of the concentrated acid to react at greater distances from the well bore.

In the chemistry of acidizing there have been developed a number of additives to HCl. These include the corrosion inhibitors, and wetting agents which sometimes are added to the acid. Sometimes the oil from the pay section being treated will emulsify badly with the spent acid solution, in which case de-emulsifying may be added to assist in keeping the first oil produced from the well of pipeline quality.

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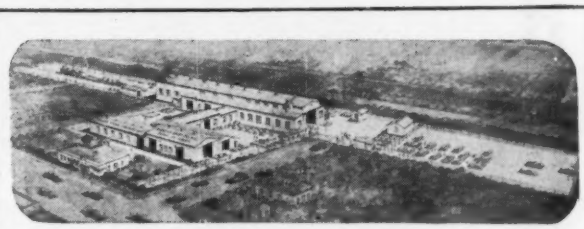

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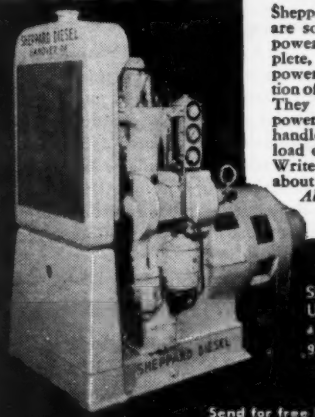

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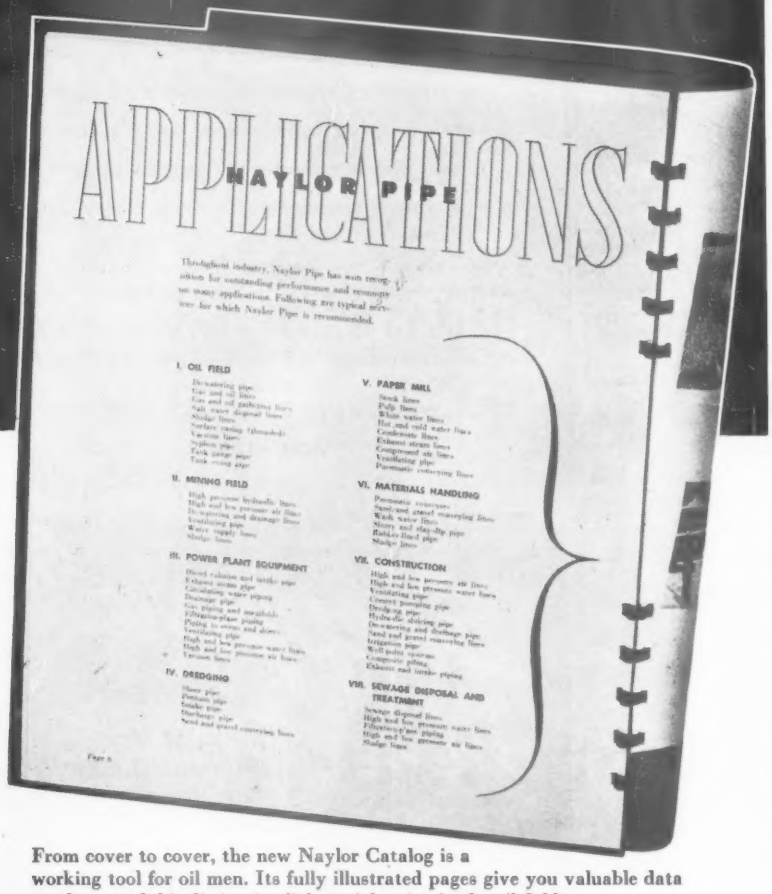

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Natural Gas

FPC Dismisses Complaint Of Mississippi P. & L.

WASHINGTON.—On the ground it is without authority under the Natural Gas Act to grant the relief requested, Federal Power Commission has dismissed a complaint filed by Mississippi Power & Light Co. against Memphis Natural Gas Co. alleging the rates charged by the Memphis company for natural gas services from June 21, 1938, to July 26, 1943, were discriminatory, preferential, unjust, unreasonable, and in violation of its contract.

During the period named, Mississippi filed no protest. The other company's rates were on file with the commission, which did not fix different rates.

In its complaint Mississippi requested the commission to "determine the just and reasonable rate for gas delivered to the city gate, fixing the same by order."

The FPC order points out that Section 5(a) of the Natural Gas Act authorizes the commission after hearing to "determine the just and reasonable rate, charge, . . . or contract to be thereafter observed and in force, and . . . fix the same by order."

The order also cites the Provisional Rules of Practice and Regulations under the Natural Gas Act which stipulate that "no natural-gas company shall directly or indirectly demand, collect, or receive, from the transportation or sale of natural gas subject to the jurisdiction of the commission . . . any rate or charge different from that prescribed in its rate schedule or schedules actually on file with the commission, unless the commission shall, for good cause shown, otherwise provide by order."

Carmouche Made Head of Gas Personnel Conference

SHREVEPORT.—H. D. Carmouche, general superintendent of Houston Pipe Line Co., was elected chairman of American Gas Association Personnel Conference, which held its tenth session here. W. H. Senyard, New Orleans, personnel director for Louisiana Power & Light Co., was chosen vice chairman.

M. V. Cousins, personnel director for United Gas Pipe Line Co. and outgoing chairman, told the delegates that since the last previous meeting urgent industrial-relations problems have arisen, making continuance of the conference advisable. This view was confirmed by Kurwin R. Boyes, secretary of A.G.A., and Gordon M. Peterson, Public Service Electric & Gas Co., Newark, N. J., who is chairman of the personnel committee of A.G.A.

Boyes and Peterson outlined industrial-relations activities. Among topics discussed were reduction of the work-week to prewar levels, employee training, and handling of returning war veterans.

FPC Accepts Rates Filed By Colorado Interstate

WASHINGTON. — Federal Power Commission has accepted new rate schedules filed by Colorado Interstate Gas Co. which reduce its interstate wholesale natural gas rates by $2,793,000 a year based on its 1944 sales. In accordance with the commission's order of March 18, 1942, which was upheld by the Supreme Court of the United States, the new rates are to be made effective on all bills rendered on and after May 20, 1942.

The company will be required to refund to customers more than $8,500,000, representing the difference between the reduced rates which the commission ordered to be put into effect in May 1942 and rates the company has continued to charge during the 3 years in which it unsuccessfully contested the commission's order in the court. The new rates will effect a reduction of 41 per cent in the company's revenues from the sale of gas to distribution companies in Colorado and to two pipe-line companies serving communities in Colorado, Wyoming, Kansas, Nebraska, Iowa, Illinois and Indiana, and will cut the company's average rates from 26 cents per 1,000 cu. ft. to 15 cents to customers served from its Denver pipe line.

Since May 1942 the company has deposited with the United States Court of Appeals for the Tenth Circuit $6,842,000, to be refunded to customers if the commission's order was upheld by the courts. The refund of $8,500,000 to be made as a result of the rates accepted by the commission will exceed the funds impounded by $1,658,000 and represents an added 25 per cent over deposits with the court. Colorado Interstate must now pay in this additional $1,658,000.

The new rates will make the following annual reductions in Colorado Interstate's charges to its customers (based on 1944 sales): Public Service Co. of Colorado, $1,498,000; Colorado-Wyoming Gas Co., $242,000; City of Colorado Springs, $169,000; Pueblo Gas & Fuel Co., $135,000; Citizens Utilities Co., $62,000; Natural Gas Pipeline Co. of America, $687,000.

A.G.A. Has Committee on Natural-Gas Reserves

NEW YORK.—The Natural Gas Department of American Gas Association has established a committee on natural-gas reserves, whose function will be to prepare and maintain estimates of the country's reserves of natural gas. R. H. Hargrove, chairman of the Natural Gas Department, says it is planned to have the work of the committee correlated with that of the American Petroleum Institute's committee on oil reserves so that there may be an interchange of information and findings.

The natural-gas committee is composed of the following men who represent various gas-producing areas: N. C. McGowen, chairman, Shreveport, United Gas Corp.; Lyon F. Terry, vice chairman, New York, The Chase National Bank; R. M. Bauer, Los Angeles, Southern California Gas Co.; R. O. Garrett, Shreveport, Arkansas Louisiana Gas Co.; Charles C. Hoffman, Oklahoma City, Cities Service Gas Co.; W. T. Nightingale, Rock Springs, Wyo., Mountain Fuel Supply Co.; Perry Olcott, Houston, Humble Oil & Refining Co.; E. E. Roth, Charleston, W. Va., United Fuel Gas Co.; Paul C. White, New York, Southwest Gas Producing Co.

F. S. Lott, assistant chief of the petroleum economics division, Bureau of Mines, will serve as a member of the committee to coordinate its reserve estimates with the bureau's gas-production statistics. Walter E. Caine, chief statistician of A.G.A., will serve as secretary.

Gasoline Production Corp. Plans New Cycling Plant

AUSTIN. — The Texas Railroad Commission will hold a hearing November 13 on an application filed by Gasoline Production Corp. for permission to conduct cycling operations in the West Tuleta, Ray-Wilcox, and Mineral fields, Bee County. The proposed plant would process 40,000,000 cu. ft. of gas daily.

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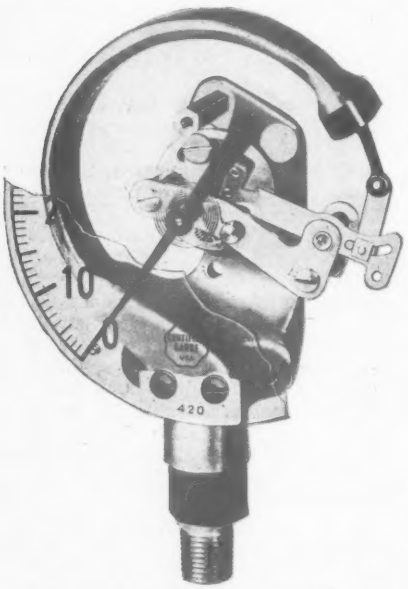

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REFINING

Marked Rise Recorded in Production of Toluene

WASHINGTON.—The total output of toluene from all sources (excluding plants under ordnance control) was 134,000,000 gal. in 1944, compared with 96,000,000 in 1943 and 43,000,000 in 1942. This is shown by the U. S. Tariff Commission's preliminary report on production and sales of synthetic organic chemicals and the raw materials of which they are made.

Most of the toluene was produced synthetically from petroleum rather than coal tar—96,000,000 gal. in 1944 and 58,000,000 in 1943.

Dutch East Indies Plants Suffer Heavy Damage

NEW YORK.—Reports received here from oil companies with refining and producing operations in the Netherlands East Indies indicate that wartime damage was even more serious than first estimated. Most of the refining properties of Netherlands Colonial Petroleum Co. in Palembang and Sumatra were wrecked by bombing operations before they were overrun by the Japanese, and the enemy was able to make little use of the facilities.

H. A. Van Karnebeek, in the field as chief representative of the company, which is a subsidiary of Standard Oil Co. of New Jersey, said with reference to prospects for resumption of operations, "so far as producing and refining are concerned, it will take a long time."

The 100-mile pipe line from the Pendopo fields to Palembang was wrecked by the Dutch and then partly repaired by the Japanese.

Van Karnebeek did not know the conditions of the wells, but reported he had reason to believe they were still producing. The storage tanks in Surabaya were ruined by Allied bombing. Those at Tandjungpriok were blown up by the Dutch. At the latter place, Karnebeek said, the Japanese made some efforts to rebuild. Nothing is known yet about the condition of the smaller tanks in Semarang.

Pieter Feith, representative of N. V. de Bataafsche Petroleum Maatschappij, a Royal Dutch-Shell combine affiliate, has opened headquarters in Batavia, Java. He reported that his company's refinery at Tjepu, near Surabaya, which had been destroyed by the Dutch, had been partly rebuilt by the Japanese. The pipe line to Tanjongperak, Surabayas port, was repaired by the Japanese. The company's warehouses at Tejegong were demolished.

Gulf Coast Gasoline Stocks Continue Their Decline

HOUSTON.—Stocks of all gasolines and naphthas at plants in Gulf Coast Refiners Association continued their decline in the second half of September, the total standing at 1,382,724 bbl. at the month's close, a drop of 182,664 bbl. A year ago total stocks were 1,407,091 bbl.

Aviation gasoline stocks September 30 were 622,435 bbl., a decrease of 58,878. Automotive gasoline stocks considered alone were 470,215 bbl., a decrease of 118,739. A year ago automotive gasoline stocks totaled 477,221 bbl.

Stocks of various grades of naphtha decreased 5,048 bbl. from the 295,121 in tanks on September 15. A large portion of this naphtha is earmarked for butadiene operations.

Kerosene stocks at 230,702 bbl. on September 30, an increase of 61,226. Diesel gas-oil stocks were 475,713 bbl., an increase of only 728. Stocks of other grades of gas oil increased 182,759 bbl. to 1,064,644.

Total stocks of all products in the association's plants were reported

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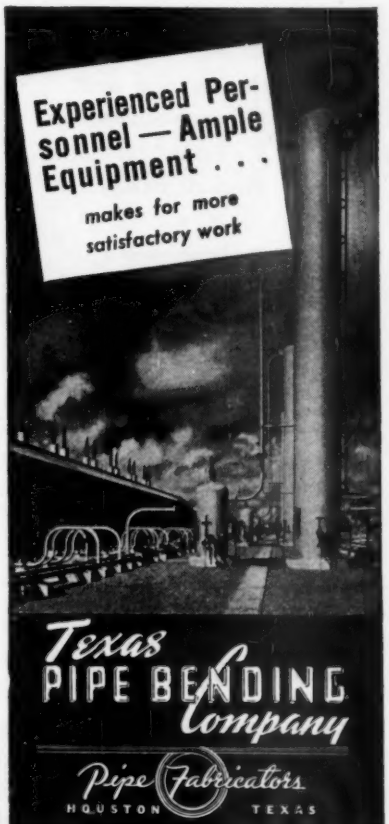
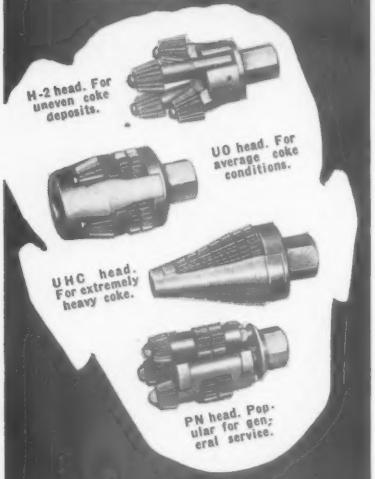


Heads that win!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at 3,562,544 bbl., showing a decrease of 169,827. A year ago total products stocks were 3,662,143 bbl.

Crude runs to stills totaled 135,701 bbl. daily, which is at 91 per cent of present rated capacity. A year ago the group processed 117,542 bbl. a day.

A.S.T.M. Reports on Tests Of Cracker Distillates

NEW YORK.—Tests run by 34 laboratories show heating oils made in catalytic-cracking units will require no drastic changes in oil-burner design, according to the report of a technical subcommittee of American Society for Testing Materials.

Results of the laboratory tests on the cracker distillates were described by Frank H. Faust, committee chairman after a year's study. Findings will be used for setting up new standards for both catalytic and straightrun fuel oils, Faust said.

The study revealed that cracker distillate has a higher B.t.u. rating because of its greater specific gravity, although reports from the burner trade said it tends to gum. The problem of quality was raised in the East about a year ago and it resulted in a resolution by the District 1 distribution and marketing committee for a 40-60 blending of the catalytic fuel oil with kerosene to bring the product to acceptable standards. Later the district general committee tabled the recommendation.

The refining industry generally and PAW took the position that the cracker distillate problem was not basically acute and that comparison on its performance was difficult because many burner owners were not using a true No. 2 oil but a high or kero blend.

The A.S.T.M. report indicates that cracker distillate will continue to be the standard fuel-oil product even after the end of the wartime high-octane gasoline program, and that what difficulties have been encountered with the No. 2 oil will be solved by fairly simple burner adjustment.

Refiner and Manufacturer Urged to Work Together

CHICAGO.—Closer cooperation between the oil refiner and the manufacturer, as a help to the lubrication engineer, was urged by W. A. Johnson, special engineer for International Harvester Co., at a meeting of the Chicago section of American Society of Lubrication Engineers.

One suggestion was that refiners provide a catalog of their various products, with explanation of their specific uses. If specifications were given along with brand names and labels on petroleum products, it would insure selection of the right product for a given purpose, Johnson said.

Discussing industrial applications of lubricants and coolants, Johnson named nine general applications for petroleum products in the metal-cutting industry as lubricants, cutting mediums and coolants, rust-proofing oils, solvents and cleaners, fuels, foundry core oils, hydraulic oils, transformer oils and quenching oils.

Johnson pointed out that a hydraulic medium should contain anti-oxidation, antirust and lubricity additives, and he stressed the importance of clean filters,

Correct functioning of a machine, Johnson said, calls not only for the right brand of oil but for the right qualities in the oil. He suggested industries might employ a simplified coded lubrication such as a color scheme for oil cans, grease guns and other containers so that any machine operator would only have to match colors.

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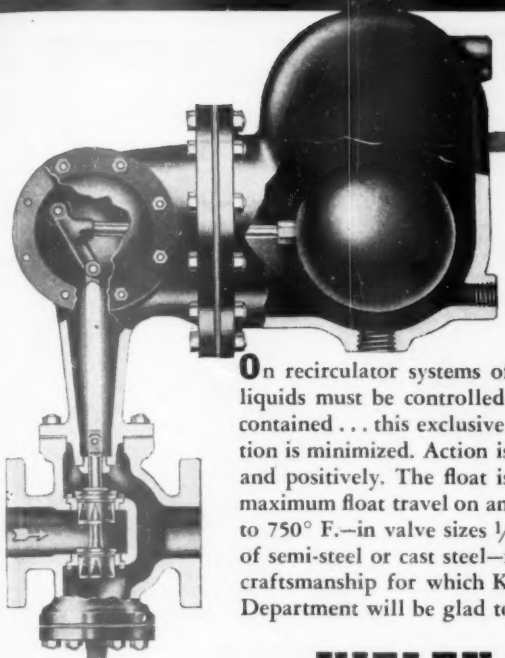

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PIPE LINES

Great Lakes Purchases 25 850-Hp. Diesels

Great Lakes Pipe Line Co. has contracted the purchase of 25 turbo-driven 850-hp. diesel engines to drive centrifugal pumps through step-up gears, for units which will be installed at pump stations on the Barnsdall-Kansas City-Des Moines and the Kansas City-Sioux Falls sections of the company's system in the process of construction.

For the construction of the 370 miles of 8-in. which has been contracted for construction this year, pipe has been arriving for the three most northern spreads; these spreads are for the line from Omaha to Sioux Falls, S. D. Between Kansas City and Omaha 200 miles will be constructed by the Great Lakes company in the spring of 1946. Arrangements have been made to have all of the contracted 370 miles wrapped with Fiberglas in order to improve the application of coating. The coating is also wrapped with spiral asbestos felt.

Midwestern Constructors, contractor at the northern section, has a field office at 518 Warnock Building, Sioux City, Iowa, under R. H. Dodson, superintendent; C. W. Sternberg has an office at Sioux Falls; Williams Brothers Corp. operations are supervised from Blair, Neb., by H. L. Davis and T. E. Davis. In addition to its section from Omaha to the Missouri River, Williams Brothers has a contract for laying two 8-in. lines across the Missouri River.

The Williams Brothers organization is laying a 7-in. line across the Ohio River near Lawrenceburg, Ind., for Ohio Oil Co.

Metropolitan Eastern Hearing Is Postponed

Federal Power Commission has postponed from October 15 to January 15, a scheduled hearing on an application of Metropolitan Eastern Corp. for authority to build 825 miles of natural gas pipe line from the Carthage field, Texas, to a point in the vicinity of Cincinnati.

Michigan-Wisconsin Seeks FPC Permit

Michigan-Wisconsin Pipe Line Co. has asked Federal Power Commission authority to construct a 1,216-mile natural-gas pipe line from Hansford County, Texas, to Detroit, The line, if approved, would run from the Hugoton gas fields, Hansford County, to markets in Missouri, Iowa, Illinois, Wisconsin, Indiana, and Michigan, terminating at Detroit. Initial construction cost was estimated at $49,000,000.

Although the entire project will have a total of 1,216 miles of pipe, the initial construction will be limited to about 1,076 miles. Of the total, 816 miles would be of 26-in. and the remainder of 22-in. pipe. The project further includes the construction of necessary lateral lines, and one 900-lb. compressor station in Hansford County. Additional stations would be installed from year to year as required by load growth. Initial capacity of the line out of the Hugoton-Panhandle fields would be 150,000,000 cu. ft. per day. Through the use of the

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Austin and other gas storage fields in Michigan, now owned by American Light & Traction's subsidiary, Michigan Consolidated Gas Co., a maximum day's requirements in excess of 630,000,000 cu. ft. of gas could be supplied by the fully completed system. Michigan Consolidated proposes to construct about 140 miles of 26-in. line connecting the Austin field with the Detroit area, as well as a compressor station at the Austin field.

Construction is to start about March 1, 1946.

The gas supply for the proposed pipe line would be purchased from gas reserves in the Hugoton-Panhandle fields in Texas and Oklahoma, owned and controlled by Phillips Petroleum Co., and estimated to be not less than 3 trillion cubic feet. Total sales for the fifth year of operation are estimated in the application at 105,120,000,000 cu. ft.

Michigan-Wisconsin said the purpose of the new line would be to enable Michigan Consolidated to continue serving the Detroit and Ann Arbor areas. The company said the line also would:

1. Serve districts in western Michigan when Michigan Consolidated Gas Co. supplies run low.
2. Provide gas for Milwaukee and Madison, Wis., served by two other American Light & Traction subsidiaries.
3. Lower natural gas rates for consumers.
4. Strengthen the financial position of the operating subsidiaries, prior to dissolution of American Light & Traction Co.

The service proposed to be rendered initially and for the first 4 years, would consist of supplying Michigan Consolidated Gas Co. with all its requirements of natural gas in excess of those supplied under contract by Panhandle Eastern Pipe Line Co., and the entire natural-gas requirements of Milwaukee, Racine, Beloit, Janesville and Madison, Wis.; Rock Island and Moline, Ill.; Des Moines, Davenport, Cedar Rapids, Ottumwa, Fort Dodge and 36 smaller Iowa communities, and Maryville, Mo. In the fifth year, all of above would be supplied plus Michigan Consolidated requirements.

Construction Projects Contracted in Venezuela

Creole Petroleum Co. has contracted with Williams Brothers Corp. for the construction of the 250-km. El Sombrero-Chaguaramos road in Estado Guarico, eastern Venezuela, which may be extended to a point in the Lezama area. Later the road system may be extended to Puerta la Cruz.

Mene Grande Oil Co. is reported to have let a contract to Chicago Bridge & Iron Co. for approximately 30 miles of 16-in. loop on the Oficina-Puerta la Cruz 16-in pipe line.

Arabian Line Terminal at Haifa

H. D. Collier, president of Standard Oil Co. of California, reported today that agreements had been approved which would establish, Haifa, Palestine, as the Mediterranean terminal of a 1,000-mile, 26-in. pipe line from Saudi Arabia and open a vast new oil supply to Europe and points west.

British authorities in Whitehall have given the project clearance, Collier said.

Standard Oil Co. of California and The Texas Co. have leases on more than 200,000 sq. mi. of Saudi Arabia, covering one of the richest oil reserves in the world. Collier said the subsidiary Arabian-American Oil Co. planned to bring out only about 200,000 bbl. a day.

Negotiations for concessions necessary to build a pipe line for the Trans-Arabian Pipe Line Co., jointly owned by Standard and Texas, have begun, according to official announcement. Rights-of-way to the Mediterranean will be secured, and the line built, when conditions warrant, the companies state.

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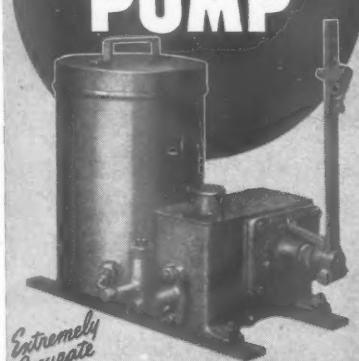

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Exploration and Drilling

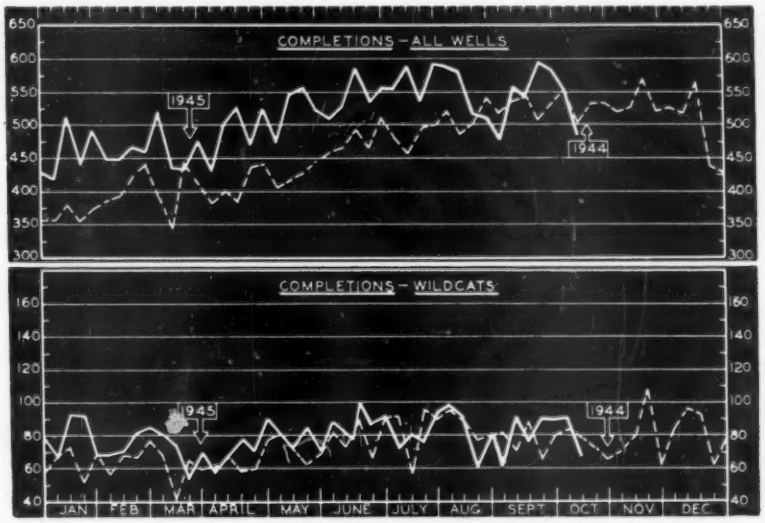
Week's Highlights

PRESIDENT TRUMAN'S recent action in setting up by proclamation United States jurisdiction over the natural resources of the offshore area known as the continental shelf, has raised questions as to how imminent oil development possibilities might be in this area.

The answer is that it is nearer than many realize, and this answer does not refer to a matter of a few thousand feet offshore, but to a matter of miles in some places. The major questions involved are: (1) oil possibilities; (2) exploration techniques, and (3) drilling techniques.

Offshore oil prospects are excellent in several areas. For instance, in the Upper Gulf Coast of Texas the crescent of salt domes paralleling the coast line cuts off abruptly on the west end. When the salt domes were formed, the western shore line of the Gulf was probably farther east, and chances are good that offshore from the present western land end of the crescent, a continuation of the belt will be found under water. Another case is the East Coast. There the sedimentary column feathers out against the mountains within a short distance from the sea. Offshore to the east the sedimentary column thickens rapidly, adding far more cubic miles of possible oil-bearing formations per horizontal mile than are present onshore west of the coast line.

Exploration techniques hinge mainly on two instruments, gravimeter for reconnaissance, and seismograph for detailing favorable areas indicated in the reconnais-



Solid line charts current weekly completions, service wells in Eastern area included

WEEKLY WELL COMPLETIONS . . . WEEK ENDED OCTOBER 13, 1945

	Total of all wells					Cum. to date		Wildcat completions and discoveries					Cumulative total, 1945				
	Comp.	Oil	Gas	Dry	Footage	1945	1944	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	28	14	0	*14	48,050	1,143	1,233	0	0	0	0	0	0	0	0	0	0
Pennsylvania	83	39	11	†33	135,996	3,222	3,267	0	0	0	0	0	0	0	0	0	0
West Virginia	18	3	12	3	44,239	630	684	0	0	0	0	0	0	0	0	0	0
Ohio	23	4	6	13	56,626	744	783	0	0	0	1	1	0	0	12	51	63
Indiana	3	2	0	1	8,065	154	200	0	0	0	0	0	5	0	0	23	28
Kentucky	12	5	1	6	24,144	416	583	1	0	0	4	5	20	0	4	43	67
Illinois	31	17	0	14	82,173	1,401	1,476	0	0	0	6	6	40	0	0	247	287
Michigan	12	2	2	8	24,599	595	519	0	0	0	6	6	9	0	3	219	231
Kansas	21	11	2	38	66,419	1,341	1,434	1	0	0	3	4	30	0	12	264	306
Neb., Mo., Iowa	0	0	0	0	0	19	31	0	0	0	0	0	0	0	0	14	14
Oklahoma	36	22	2	12	148,277	1,893	1,411	0	0	0	3	3	70	3	15	281	369
Texas	122	65	16	41	577,542	5,630	4,356	1	1	0	24	26	164	13	49	995	1,221
North Central	38	22	1	15	114,844	1,734	1,147	1	0	0	7	8	63	0	5	349	417
West	25	17	1	7	125,331	1,391	1,223	0	0	0	5	5	43	1	0	199	243
Panhandle	10	3	6	1	33,598	441	207	0	0	0	1	1	0	0	1	6	7
Eastern	12	4	5	3	71,635	268	255	0	1	0	2	3	5	7	2	67	81
Gulf Coast	27	15	2	10	193,605	1,287	984	0	0	0	5	5	39	4	32	226	302
Southwest	10	4	1	5	38,529	509	540	0	0	0	4	4	14	1	9	147	171
Louisiana	17	11	4	2	110,534	815	625	1	0	0	1	2	26	3	*6	96	131
Northern	8	3	4	1	33,130	332	250	0	0	0	1	1	7	1	6	55	69
Southern	9	8	0	1	77,404	483	375	1	0	0	0	1	19	2	0	41	62
Arkansas	3	2	0	1	15,178	139	172	0	0	0	1	1	1	0	0	30	31
Mississippi	10	4	0	6	70,456	291	111	0	0	0	3	3	5	0	0	97	102
Southeastern	0	0	0	0	0	46	41	0	0	0	0	0	1	0	1	32	34
Montana	14	11	2	1	26,876	253	282	0	0	0	0	0	7	0	0	21	28
Wyoming	7	2	0	5	26,159	169	136	0	0	0	4	4	14	0	1	35	50
Colorado	1	1	0	0	6,339	42	29	0	0	0	0	0	1	0	1	8	10
New Mexico	8	7	1	0	39,760	327	306	0	0	1	1	2	10	0	5	48	63
California	36	29	2	5	149,920	1,790	1,565	0	0	0	3	3	3	0	2	183	188
Total United States	485	251	61	173	1,661,352	21,060	19,244	4	1	1	60	66	406	19	111	2,687	3,223
Total previous week	552	283	57	212	1,836,078	20,575	18,732	10	0	2	80	92	402	18	110	2,627	3,157
Total Oct. 14, 1944	499	285	44	190	1,509,472	19,244	13,740	12	0	5	62	79	352	23	103	2,523	3,001

Service wells included: *14, †30, ‡1.

sance. Gravimeter experts in the petroleum industry say it is feasible to make gravimetric reconnaissance of offshore areas by use of a submarine. Secretary Ickes' experts say the same. The U. S. Coast and Geodetic Survey has done some work of this character over the past 10 years. Petroleum-industry seismograph experts say they are ready to take contracts to do their work in depths up to 600 ft. Their problems would be largely adaptation of present methods, and development of satisfactory service equipment.

The drilling department can't handle 600 ft. of water depth now. But in Lake Maracaibo, Venezuela, they have developed equipment and techniques that are satisfactory and commercial for depths of more than 135 ft. of water, and more than 170 ft. of water and soft mud. In many places along the coast line of the United States this would take in several miles offshore.

TEXAS GULF COAST

Oil-Showing Sands In Thompson Extension

HOUSTON.—Sands showing oil have been encountered in west extension test at Thompson field, Fort Bend County. Cecil Hagen 3 Wolters, in Samuel Kenedy Survey, recorded oil sand from 5,379-5,401 ft. and 5,417-39 ft. Operators are now waiting on cement to set after 5½-in. casing was set at total depth of 5,445 ft.

Deep Wilcox test, which is deepest hole ever drilled in the old Tomball field of northern Harris County, Humble Oil & Refining Co. 10 Milo et al, is drilling ahead below 13,449 ft. in hard sandy shale. Also this is deepest test for Harris County.

National Associated Petroleum Co. 1 W. S. Swilley, wildcat in John Coughran Survey, approximately 15 miles northeast of Liberty, in Liberty County, was dry at total depth of 8,890 ft.

There were 23 new locations reported this week, 2 of which were wildcats, 1 each in Liberty and Matagorda counties. Of the 15 completions 3 were dry wildcats, 1 each in Liberty, Matagorda, and Wharton counties. Jefferson and Wharton counties led with three completions each.

WILDCAT FAILURES COMPLETED IN UPPER GULF COAST

Liberty County: National Associated Petroleum Co. 1 W. S. Swilley, John Coughran Sur., Abs. 8, 15 miles northeast of Liberty, dry at 8,890 ft.

Matagorda County: Sun Oil Co. 1 Olcese Estate, North Bay City area, Hosea League, Abs. 57, 1 mile north of production on west side of North Bay City field, dry at 9,004 ft.

Wharton County: M. Thompson 1 Bessie Hudgins, Morris & Cummings Sur., Sec. 18, 8 miles southwest of Louise, dry at 6,520 ft.

SOUTHWEST TEXAS

Riverside Field Gets Another Producer

CORPUS CHRISTI.—Another producer has been added to the Riverside field by Stanolind Oil & Gas Co. 7 J. A. Thompson. On production test this well flowed 73 bbl. of oil per day through a 6/64-in. choke from perforations at 6,281-83 ft. Tubing pressure was 940 lb., gravity 39°, and gas-oil ratio 557 to 1. Total depth is 6,603 ft. with 5½-in. casing set at 6,415 ft.

In the Kelsey field, Brooks County, Magnolia Petroleum Co. completed 17 State-Marshall, flowing a potential of 135 bbl. of 38°-gravity oil per day through a 5/32-in. choke, no water. Tubing pressure 600 lb., gas-oil ratio 760 to 1. Production is from 24 perforations at 5,730-36 ft. Total depth is 6,900 ft. with 7-in. casing set at 6,335 ft.

Glenn H. McCarthy 1 C. L. Cartwright, wildcat 1 mile northeast of Hinnant field in Live Oak County, was dry at 6,014 ft.

Argo Oil Corp. 1-D John E. Murphy, wildcat 7 miles northeast of Seven Sisters in BS&F Survey 110, McMullen County, was dry at total depth of 3,148 ft. after drill-stem test in the Pettus sand recovered 1,500 ft. of salt water.

La Gloria Corp. 1 W. A. Jennings, wildcat 5 miles north of Mathis, in John P. Borden Survey, Abstract 338, San Patricio County, dry at a total depth of 4,744 ft. A drill-stem test at 4,217-24 ft. recovered salt water.

There were 33 new locations reported this week with 6 being wildcats, 2 in Bee County, and 1 each in Bastrop, Brooks, Victoria, and Webb counties. Of the 22 completions 6 were dry wildcats, 2 in Bastrop County, and 1 each in Gillespie, Kenedy, McMullen, and San Patricio counties. Atascosa, Bastrop, Brooks, Duval and San Patricio counties each had two completions.

WILDCAT FAILURES COMPLETED IN SOUTHWEST TEXAS

Bastrop County: John A. Drossos 1 A. J. Caldwell, Geo. J. Glasscock Sur., 2½ miles east of Elgin, dry at 2,203 ft.

R. V. Muckleroy 1 Mrs. Nettie Oshier et al, Reuben Gage Sur., Blk. 5, 3 miles southwest of Cedar Creek, dry at 1,758 ft.

Gillespie County: L. Underwood Rowntree 1 Richard Knott, Sur. 154, 8 miles east of Harper, dry at 700 ft.

Kenedy County: Humble Oil & Refining Co. 3 C. M. Armstrong, La Barreta Grant, 2 miles east of Armstrong, dry at 10,606 ft.

McMullen County: Argo Oil Corp. 1-D John E. Murphy, BS&F Sur. 110, 7 miles northeast of Seven Sisters, dry at 3,148 ft.

San Patricio County: La Gloria Corp. 1 W. A. Jennings, John P. Borden Sur., Abs. 338, 5 miles north of Mathis, dry at 4,744 ft.

DAILY AVERAGE PRODUCTION FOR WEEK

	Oct. 13 crude oil	Distillate, allied products	October PAW quota all oils	Oct. 6 crude oil
Alabama	200	.....	500	200
Arkansas	76,000	5,400	80,400	76,150
California	810,500	60,970	946,970	815,000
Colorado	13,250	.....	12,000	13,500
Eastern	61,700	6,300	72,500	65,950
Florida	100	.....	.....	100
Illinois	143,100	12,000	212,000	134,700
Indiana	10,900	.....	13,000	10,250
Kansas	270,600	4,500	278,500	252,150
Kentucky	21,000	2,600	30,600	18,300
Louisiana	355,750	42,000	392,000	355,500
North Louisiana	70,750	.....	.....	70,500
South Louisiana	285,000	.....	.....	285,000
Michigan	45,200	800	47,800	44,600
Mississippi	50,850	.....	47,000	51,100
Montana	23,550	300	23,800	23,550
Nebraska	800	.....	1,000	750
New Mexico	96,450	6,800	106,800	96,400
Oklahoma	358,800	28,000	408,000	383,450
Texas	1,187,100	166,000	2,034,000	1,187,100
East Texas	177,000	.....	.....	177,000
East Central Texas	93,000	.....	.....	93,000
North Central Texas	116,300	.....	.....	116,300
Texas Panhandle	88,000	.....	.....	88,000
West Texas	260,000	.....	.....	260,000
Southwest Texas	193,800	.....	.....	193,800
Texas Gulf Coast	259,000	.....	.....	259,000
Wyoming	92,600	3,500	96,700	89,750
Total United States	3,618,450	339,170	4,803,570	3,618,500
Change from prev. week, down	50			

Total production January 1-October 13, 1945 ..... 1,355,082,275 bbl.
Same period last year ..... 1,299,749,150 bbl.

N. CENTRAL TEXAS

Jack County Wildcat Dry at 6,732 Ft.

WICHITA FALLS.—Continental Oil Co. 1 R. M. Ramzy, D. K. Davis Survey No. 4, Jack County wildcat 9 miles southeast of Jacksboro, is dry at 6,732 ft. Ellenburger was topped at 6,440 ft. Magnolia Petroleum Co. 1 Bush, J. McKerley Survey, outpost to the Sivell's Bend pool of northern Cooke County, ran a 60-minute drill-stem test from 6,514-24 ft. and recovered 80 ft. of oil-cut mud.

J. A. Chapman et al 1-A Fowler, Limestone County School Land Survey, 2 miles northeast of Stoneburg, Montague County, gaged 80 bbl. of oil the first hour of a test through perforations from 5,974-91 ft. Operator continued to test. Anderson-Prichard Oil Corp. 1 Ross, R. B. Masterson Survey, on the west side of the Ross Strawn pool of eastern King County, 13 miles southeast of Guthrie, has been completed to flow 768 bbl. of 37°-gravity oil in 14 hours. Total depth is 5,377 ft.

Wichita County had seven field completions this week, while Archer and Jack counties each had four and Montague County three. Archer County reported 13 new field locations, Wichita County 11 and Young County 7.

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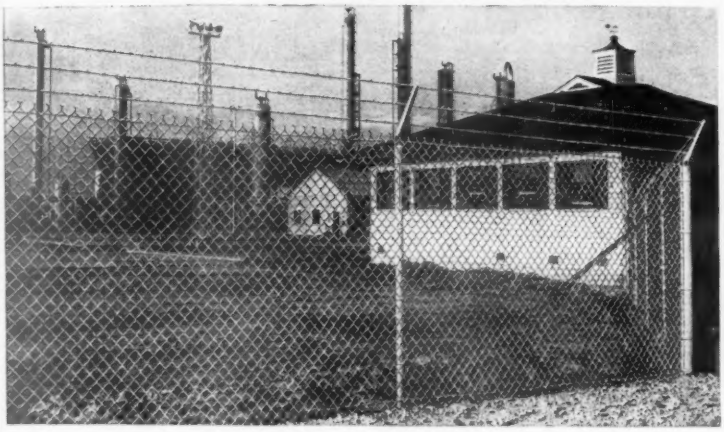

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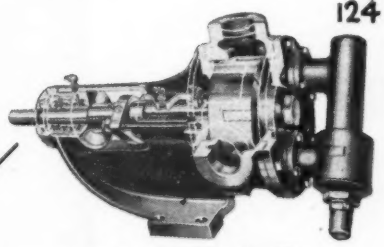

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reported two field completions and three new field locations.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCAT

Montague County: Extension to old oil pool—A. R. Dillard et al 1 Dr. J. T. Lawson, N. Kimbro Sur. A-405, 3 mi. NW Hildreth pool, elev. 900 ft., flowed 1,846 bbl. day through ½-in. choke, perf. 5,992-6,010 ft. Caddo, gravity 42°. TD 6,157 ft.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Bridwell 2 Langford Investment Co., Lot 127, Harris Subd. Club Ranch, 4 mi. N and 1½ mi. W Archer City, elev. 969 ft., Gunsite 1,397 ft., dry, TD 1,450 ft.

O. R. Hartt 2 Abercrombie & Taylor, Sec. 2, SPRR Sur. A-1281, 3 mi. S and 9 mi. W Archer City, dry, TD 1,400 ft.

Cooke County: NuEnamel 1 J. M. Maupin, R. Alexander Sur. A-13, 1½ mi. N Gainesville, Ellenburger 3,896 ft., dry, TD 3,921 ft.

Young County: Bennett & Bennett 1 Bailey, Sec. 60, TE&L Sur., ½ mi. W Orth, dry, TD 870 ft.

Panhandle Refining 1 J. W. Cloud, B. F. Taylor Sur. A-1546, 5 mi. S Murray, elev. 1,177 ft., Caddo 3,522 ft., Marble Falls 4,250 ft., dry, TD 4,300 ft.

WEST CENTRAL TEXAS WILDCAT FAILURES

Jones County: R. H. Roark and L. F. Hooker 1 J. E. Manley, Sec. 29, Blk. 14, T&P Sur., 5 mi. SE Nugent, elev. 1,678 ft., Dotham 1,305 ft., dry, TD 1,926 ft.

West Central Drlg. 1 A. C. Olds, Sec. 20, Blk. 16, T&P Sur., 4 mi. S Hawley, elev. 1,651 ft., Swastika 2,574 ft., dry, TD 2,622 ft.

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ILLINOIS

Big Wells in Calhoun, Richland County

MATTOON.—Two new wells in Richland County's Calhoun pool, producing 1,342 bbl. and 1,200 bbl., respectively, from acidized Lower O'Hara (Levias) limestone, were the feature completions of the week in Illinois. Cooperative Refining Co. 1 Rotramel, NE NE SW 7-2n-10e, found Lower O'Hara lime at 3,096-3,101 ft., total depth 3,124 ft. The well swabbed and flowed 803 bbl. in 24 hours, but when acidized flowed 1,342 bbl. in 24 hours. Later it gaged 303 bbl. in 7½ hours through 1-in. choke. C. R. Ross et al 2 Lane, SW SW NE 7-2n-10e, had Lower O'Hara lime at 3,119-31 ft., the total depth. It swabbed 100 bbl. in 10 hours, but after a 5,000-gal. acid treatment swabbed and flowed 1,200 bbl. in 24 hours.

Seventeen oil wells and 14 dry holes were reported completed during the week in Illinois. Six of the dry holes were wildcats. The total initial production recorded was 4,056 bbl. per day, which gave the week's new producers the unusually high average of 239 bbl. per well.

The Illinois Geological Survey reports that in September the following new pools and extensions were recorded:

New pools: Springerton, Hamilton County; Shawneetown, Gallatin County; Hunt City, Jasper Coutny; Stanford, Clay County; Samsville North, Edwards County.

Extensions to pools: Keenville, Wayne County; Brownsville, White County; Sailor Springs Consolidated, Clay County; Noble North, Richland County; Mt. Carmel, Wabash County; Maunie South. White County.

New producing strata were reported from the Brownsville, Boyd, Calhoun, Calvin North and Samsville in September.

Thirty-seven new operations were reported during the past week including the following wildcats: In Coles County, M. H. Richardson et al 1 Powell, SE NE SE 10-12n-7e, E. J. Davis 1 McIntyre, SW SW NW 20-12n-8e, V. M. Schell 1 B. F. Bressee, NE NE SE 15-11n-7e, and H. H. Luttrell 1 Clayton-Haybrook, 2-13n-7e; in Jasper County, J. J. Lynn 1 McGovern, C S½ SE SE 7-6n-11e; in Bond County, J. S. Roberts 1 Hoiles, SW NW NE 14-4n-3w; in Wayne County, A. J. Slagter 1 Groff, SW SW NE 31-2n-9e, and Nation Oil 1 Vaughn estate, NE NE SW 13s-7e; in Jefferson County, George L. Wrather 1 Threlkeld, SE SW NE 36-4s-2e.

ILLINOIS WILDCAT FAILURES

Clay County: J. J. Lynn 1 Campbell, SE NW SW 11-2n-5e, dry at 2,984 ft. Lower Kincaid 1,918 ft., Barlow 2,519 ft., Aux Vases 2,788 ft., McClosky 2,906 ft., St. Louis 2,984 ft.

Effingham County: George Engle 1 Parks, NW NW NW 34-7n-5e, dry at 2,525 ft. Vienna 1,904 ft., Cypress 2,198 ft., Renault 2,345 ft., McClosky 2,505 ft.

Madison County: Lessing Alch 1 Hollman, NE NW SE 8-4n-7w, dry at 2,286 ft. Ste. Genevieve lime 700 ft., Louisiana 1,539 ft., Devonian 1,665 ft., Trenton 2,186 ft.

Richland County: R. B. Martin and Wood 1 Schernekan, SE SW NE 35-2n-14w, dry at 3,001 ft. Lower Menard 2,126 ft., Barlow 2,561 ft., Ste. Genevieve 2,874 ft., McClosky 2,914 ft.

Wayne County: Nation Oil 1 L. Brown.

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EASTERN TEXAS

Nacogdoches Wildcat Drilling Below 8,165 Ft.

DALLAS. — Magnolia Petroleum Co. 1 Harrell, Wm. Wray Survey, wildcat 2½ miles southeast of Waterman, Nacogdoches County, cored from 8,106-16 ft. and recovered sand with good odor of oil. It was drilling below 8,165 ft. in the Travis Peak. M. J. Delaney 1 Earl Holt, Samuel Stewart Survey, 3 miles south of Daingerfield, Morris County, topped the Travis Peak at 8,514 ft. It was drilling ahead at 8,542 ft. with no shows reported.

Phillips Petroleum Co. 1 Carver, Long Survey, offset to the discovery in the South Tyler pool, Smith County, was preparing to reperforate after squeezing perforations from 9,910-15 ft. Sinclair Prairie Oil Co. 1 Schofner, Dickerson Survey, deep test on the south end of the Chapel Hill structure of eastern Smith County, was circulating and conditioning mud at 13,518 ft. Humble Oil & Refining Co. 1 Pickering Lumber Co., S. Francois Survey, wildcat in the Huxley area of eastern Shelby County, lost returns and recemented at total depth of 10,986 ft. Operator was waiting on cement to set.

Carthage field, Panola County, had three completions this week and Pickton field, Hopkins County, had two. Pickton field and Sand Flat field, Smith County, each reported two new locations.

EASTERN TEXAS SUCCESSFUL WILDCAT

Freestone County: New gas-distillate pool —Texas 1 Mrs. Nancy Ham, R. Lawson Sur., 4 mi. E and slightly S Teague, elev. 494 ft., flowed 13,000,000 cu. ft. gas per day with 5 to 8 bbl. dist. per mil. cu. ft. gas open flow, TD 8,541 ft.

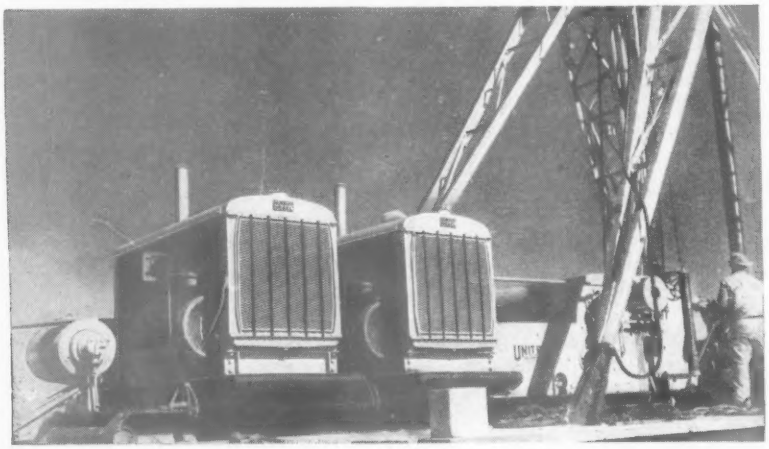
EASTERN TEXAS WILDCAT FAILURES

Freestone County: Blackwell Oil & Gas 1 Wasson, Sarah McAnulty Sur., 2 mi. SE Wortham, dry, TD 3,308 ft.

Navarro County: Cathriner-Smith 1 Copeland, J. Latham Sur., 5 mi. W Richland, Woodbine 2,444 ft., Georgetown 2,538 ft., dry, TD 2,573 ft.

PANHANDLE WILDCAT FAILURE

Dallam County: Texas 1 Capitol Freehold Land Tr., Sur. 10, Blk. 7, Capitol Syndicate lands, 9 mi. S Texline, Ellenburger 5,605 (?) ft., pre-Cambrian 6,152 ft., dry, TD 6,169 ft.



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PERMIAN BASIN

Midland County Gets First Oil Flow

MIDLAND.—Humble Oil & Refining Co. 1 Mrs. O. P. Buchanan, Section 32, William Baldridge Survey, discovery 9 miles southeast of Midland, gives Midland County its first oil production. The well was treated with 2,000 gal. through perforations from 10,370-90 ft., using 40-bbl. oil load. The well unloaded and returned oil load in 20 minutes. It was turned into pits to clean out, connected to tanks and in the first 8 hours flowed 107 bbl. of fluid, cut 9 per cent with fresh water and 11 per cent with sludge. Net oil flow was 86 bbl. of 43.1°-gravity. Gas-oil ratio was 5,820 to 1. Production is from the Strawn lime section of the Pennsylvanian. The well was drilled to 12,574 ft. in the Ellenburger where it proved to be a failure. It was still testing.

Eltex, Inc., 1 E. L. Martin, William Hughes Survey No. 6, which opened the first oil production in Concho County 4 miles northwest of Eden, was assigned a daily allowable of 80 bbl. The well was completed October 2 for a flow of 81 bbl. of 44°-gravity oil in 3 hours. Production is in the Bend section of the Pennsylvanian through perforations from 3,801-09 ft. The company has staked an east offset to the discovery as its 2 Martin.

Andrews County.—Sinclair Prairie Oil Co. 1 Ratliff, Section 25, Block 73, Public School Lands, wildcat 5½ miles southeast of Shell Oil Co., Inc., and The Texas Co. 1 Ratliff & Bedford, four-pay discovery in southwestern Andrews, ran a 45-minute drill-stem test in the Silurian from 9,688-9,780 ft. Recovery was 1,980 ft. of clear water, 1,080 ft. of water cut with oil and gas and 6,080 ft. of black sulfur water. Humble 1 Parker, Section 24, Block A-41, Public School Lands, ¼ mile west of Sun Oil Co. 1 Martin, Permian lime discovery in central Andrews, was cored from 8,902-10 ft. in the Waddell section of the Simpson and recovered 4½ ft. of sand showing oil. Another core cut from 8,910-26 ft. recovered 12 ft. of shale and lime with no shows. Operator plans to run a drill-stem test of this section. Humble 88-X Means, Section 9, Block B-35, Public School Lands, deep test in the Means pool, was drilling below 13,960 ft. in lime.

Amerada Petroleum Corp. 1-A Jones, Section 3, Block A-6, Public School Lands, discovery 7 miles northwest of the Russell pool, Gaines County, swabbed 66 bbl. of fluid in 19 hours through perforations at 9,115-25 ft. The fluid was 98 per cent water and 2 per cent oil. Operator will test further.

North Ward-Estes field, Ward and Winkler counties, had three completions, while Keystone-Ellenburger field, Wink-

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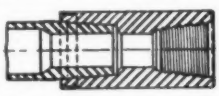

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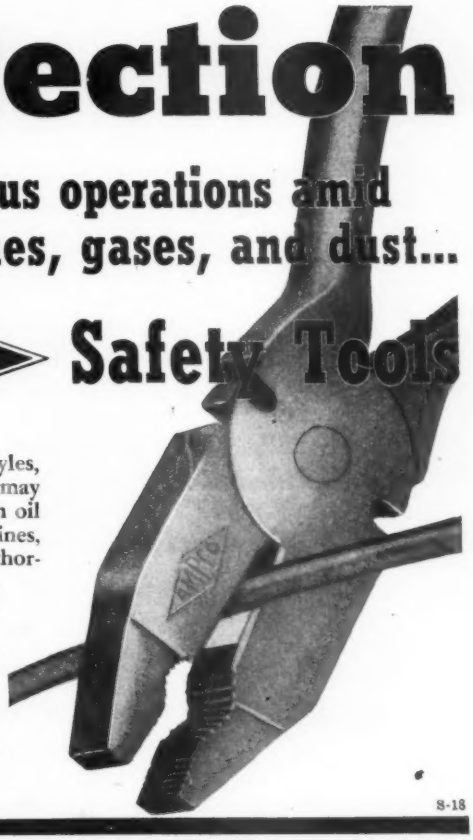

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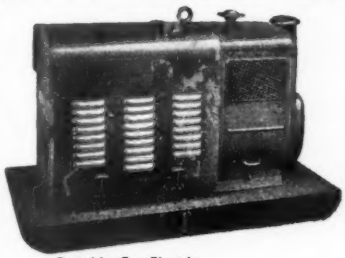

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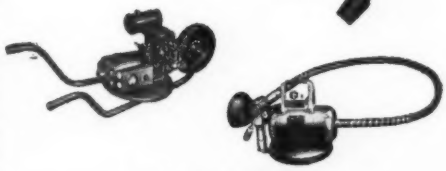

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ler County, and Slaughter field, Cochran County, each had two. The Fullerton-Devonian field, Andrews County, reported four new locations and Garza field, Garza County, Sharon Ridge field, Scurry County and Fullerton field, Andrews County, each reported three.

WEST TEXAS WILDCAT FAILURES

Fisher County: Sohio Pet. 1 Mrs. Keith Newman, Sec. 2½, John Rodman Sur., 2½ mi. SE Roby, elev. 1,949 ft., Ellenburger 6,160 ft., dry, TD 6,211 ft.

Howard County: Hickock & Reynolds 1-H Noble Read, Sec. 16, Blk. 30, T-1-N, T&P Sur., 5 mi. NE Coahoma, elev. 2,307 ft., dry, TD 2,960 ft.

Lamb County: Humble 1 Bagwell, Lab. 25, Lge. 673, State Capitol lands, 3 mi. SW Littlefield, elev. 3,527 ft., San Andres 3,465 ft., dry in Pennsylvanian, TD 9,162 ft.

Martin County: Continental 1 E. W. Douglas, Sec. 33, Blk. 34, T-3-N, T&P Sur., 4 mi. from N line and 2 mi. from E line of county, elev. 2,716 ft., Leonard 6,950 ft., dry, TD 7,200 ft.

Winkler County: Stanolind 7 Sealy-Smith Foundation, Sec. 10, Blk. A, G&MMB &A Sur., 4 mi. E North Monahans pool, elev. 2,907 ft., Glorietta 5,150 ft., Tubb 6,180 ft., dry, TD 6,900 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Stanolind Oil & Gas Co. 1 W. H. Jones, 19-19s-39e, 7 miles southeast of Hobbs, Lea County, is dry at 10,580 ft. in granite. Simpson was topped at 10,100 ft., detrital at 10,520 ft., and granite at 10,578 ft. Elevation was 3,581 ft. The Texas Co. 2 C. H. Lockhart, 12-22s-32e, on the southwest side of the Penrose field of Lea County, plugged back to 6,315 ft., perforated from 5,150-5,235 ft. and was swabbing with 3,000 ft. of fluid in the hole, mostly oil. Continental Oil Co. 1-B-22 Skaggs ½-mile northwest extension to the Skaggs pool of southeastern Lea County, with total depth of 7,748 ft., will drill ahead after having trouble with a caving hole.

Caprock field, Chaves County, and Penrose-Skelly field, Lea County, each had two completions this week. Grayburg-Jackson field, Eddy County, reported three locations.

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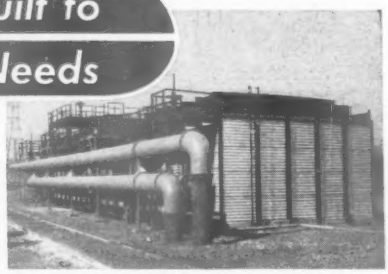

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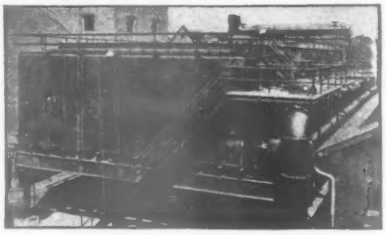

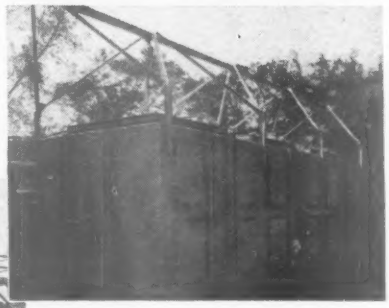

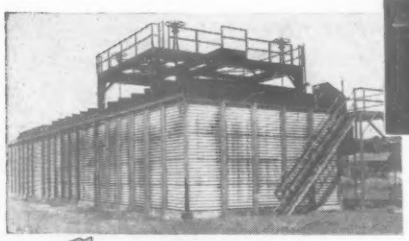

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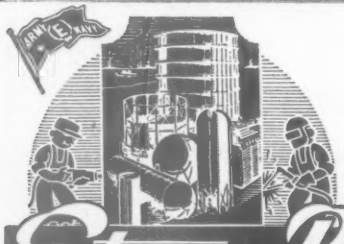

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APPALACHIAN FIELD

Large Development Program for Wyoming Co.

PITTSBURGH.—As previously indicated the largest development program of the past 2 years has been in the southern part of West Virginia in Raleigh and Wyoming counties where Columbian Carbon Co., Godfrey L. Cabot, Inc., and lately Hope Natural Gas Co. have been active in testing with some wells showing high open flows from Ravencliff, Big lime, Injun and Berea sands. Hope has just announced a large development program in Wyoming County which will entail the building of 40 miles of pipe line to service the new field.

In Preston County, West Virginia, the wildcat of William E. Snee et al on the Harry Sisler farm on Briery anticline in Portland district shut down at 6,000 ft to splice on additional cable and appeared to have reached the lime break between "A" and "B" members of the Oriskany sand at that depth. In the Corniferous chert, topped at 5,758 ft., there was a show of about 12,000 cu. ft. gas at 5,796-5,800 ft., and in the Oriskany, topped at 5,917 ft., there was a show of 12,000 cu ft. gas at 5,921-29 ft., which has continued without any decrease. The sand body has been limy throughout.

In Upshur County, Cumberland and Allegheny Gas Co. completed 397 C. M Carpenter in Buchannon district good for 1,500,000 cu. ft. gas from the Gordon sand, total depth 2,131 ft.

In Boone County, Cambridge and Harvard Gas Co. completed 12 Courtney Co through the Brown shale to 2,549 ft., and it is good for 848,000 cu. ft gas.

In Center district, Gilmer County, P. P Gunn et al completed a test on Lester Minney farm good for 564,000 cu. ft. gas from the Injun sand, total depth 2,600 ft

In Jackson County, United Carbon Co is drilling through the Oriskany sand in a test 1,296 C. M. Coast in Ravenswood district with a high gage of 5,833,000 cu ft. gas at 4,734-49 ft., with the Oriskany topped at 4,743 ft., and at 4,761 ft. the volume had frozen back to 1,600,000 cu. ft It should make a good completion.

In Marsh Fork district, Raleigh County Columbian Carbon Co. bottomed the 793 Rowland Land Co. at 3,703 ft., with Maxton sand topped at 2,550 ft.; Big lime 2,860-3,103 ft.; Injun 3,103-60 ft.; Weir 3,244 ft.; Berea 3,670-92 ft. It was filled back to 3,102 ft., and acidized with 1,000 gal., after which it gaged 684,000 cu. ft gas with 12-hour rock pressure of 690 lb The Weir may be shot before tubing.

In North Strabane Township, Washington County, southwest Pennsylvania, east of the new oil pool, Keystone Gas Co completed a good gas well as a test on Benjamin Levine farm with a gage of 2,225,000 cu. ft. gas from the Fifty Foot sand topped at 2,078 ft.; gas 2,080-90 ft.; total depth 2,091 ft.

In Beaver Township, Jefferson County T. W. Phillips Gas & Oil Co. completed a good test on A. A. Brosius farm with a gage of 1,500,000 cu. ft. gas from a total depth of 2,241 ft.

Two new locations were made in southwest Pennsylvania during the week, both in Armstrong County and in Bethel and Kittanning townships.

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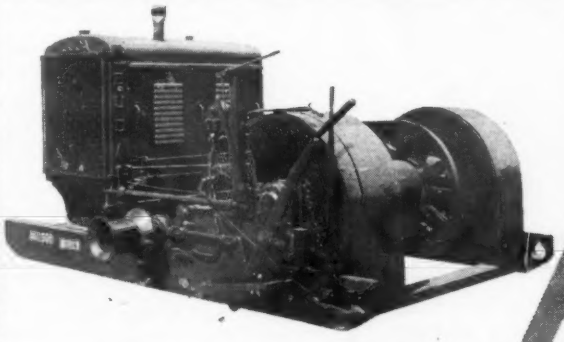

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SOUTH LOUISIANA

Two New Producers at West Tepetate Field

NEW ORLEANS.—Two new producers have been added at the West Tepetate field in Jefferson Davis Parish, one a dual sand well. The latter is Barnsdall Oil Co. 1 Landry-Stafford, which flowed 390 bbl. of 36°-gravity oil per day through a 12/64-in. choke from the lower sand, tubing pressure 1,100 lb., and made 260 bbl. daily through a 12/64-in. choke from the upper sand with 987,000 cu. ft. of gas daily. Operators are now running potentials. The single sand well was Irwin-Hudson et al 1 Houssiere-Latreille, 36-7s-3w, which flowed a potential of 272 bbl. per day on a 10/64-in. choke, tubing pressure 1,300 lb., casing pressure 2,000 lb., from the 8,500-ft. sand.

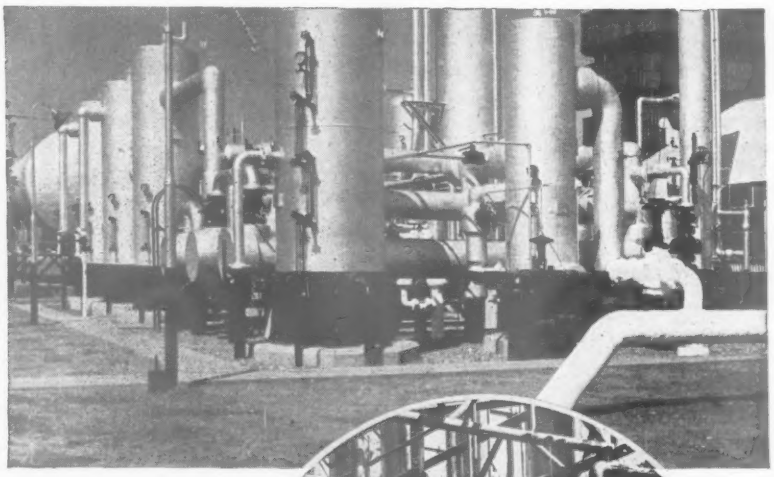
At Good Hope field in St. Charles Parish, Humble Oil & Refining Co. 4 Sarpy Brothers, 7-12s-8e, flowed 389 bbl. per day through a 3/16-in. choke, tubing pressure 1,275 lb., gravity 37°, no water, gas-oil ratio 507 to 1. Production is from perforations at 7,770-92 ft. Total depth is 8,740 ft. with 7-in. casing set to 8,440 ft.

Deep drilling is continued by Humble at its 1-B Mrs. J. A. Bel Estate, wildcat, 33-5s-4w, in Allen Parish, which is drilling below 11,581 ft. in hard shale. In St. Mary Parish, Humble 1 Warren Kearney, at Bayou Carlin, in T-16s-8e, is drilling below 11,726 ft. in hard sandy shale. Also, in St. Charles Parish, Humble 1 State-Lake Salvador, wildcat in Lake Salvador, is drilling below 11,853 ft. in hard shale and sand.

There were 15 new locations reported this week with 4 being wildcats, 1 each in Beauregard, East Baton Rouge, Iberia and LaFourche parishes. Of nine completions only one was an exploratory test, being a new sand in Avery Island field, Iberia Parish. St. Charles Parish led with two producers completed.

SUCCESSFUL WILDCAT COMPLETED IN SOUTH LOUISIANA

Iberia Parish: New oil pay, Avery Island field—Humble Oil & Refining Co. 7-B Petit Anse Co., Inc., 23-13s-5e, TD 8,848 ft., perforations 113 holes 8,648-65 ft., PT 367 bbl. day through a 10/64-in. choke, gas-oil ratio 799 to 1, TP 1,375 lb., gravity 34°, no water.



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CALIFORNIA

Troubles Plague Operators On Three Wildcats

LOS ANGELES.—Reports on three California wildcats that have shown promise of production, are of an unfavorable nature although not at all conclusive. Standard Oil Co. of California after being delayed for several days as a result of a fishing job, is again swabbing for production in 1 Lewis, a wildcat located about midway between West Coyote and Santa Fe Springs fields. On a recent formation test the well showed several short blows and operator recovered several thousand feet of mud, water, and drilling fluid. This test failed to show much oil. Subsequently the crew lost the swab and line but this has been recovered and swabbing operations are again under way. This hole is down 10,635 ft. with an effective depth of 10,293 ft. and consequently it may take time to reduce the column of fluid sufficiently to permit the well to take over.

In the Cantua region of Fresno County, Tide Water Associated Oil Co.'s wildcat on Southern Pacific property in Section 15-17s-15e, has failed to respond to swabbing operations. This test showed considerable gas pressure during drilling operations but, upon going back to the spot where weight material was required to maintain control, no appreciable amount of gas was found. It is not now known whether this pressure was merely a gas pocket or whether a possibly productive gas sand has been mudded off to such an extent that the gas has been excluded from the hole. Tide Water Associated carried this well down to 13,019 ft. and then plugged back to 11,803 ft. where a formation test was made. This test was inconclusive and operator then ran in tubing and began swabbing operations.

Ohio Oil Co. is again testing its Gardena wildcat but has been plagued with persistent water trouble. The company will either sidetrack the bottom of the hole or whipstock out of the present hole with the alternative of starting a new hole. The test is down 10,594 ft. and has 7-in. casing cemented at 10,353 ft. Shell is down 14,329 ft. in 48-A Alamitos, a deep test in the Long Beach field.

There has been a marked downward trend in drilling operations in California during the past 30 days and, as operators are faced with the necessity of restricting production to somewhere near demand, there is a possibility of a continued decline in work during the remainder of the year. Offsetting this is the fact that with PAW controls off operators are now faced with the obligation of fulfilling lease requirements and may have to resume lease development work which was suspended during the war period. Deepening operations in some fields, such as at Edison, has had a tendency to be reflected in a smaller amount of new work

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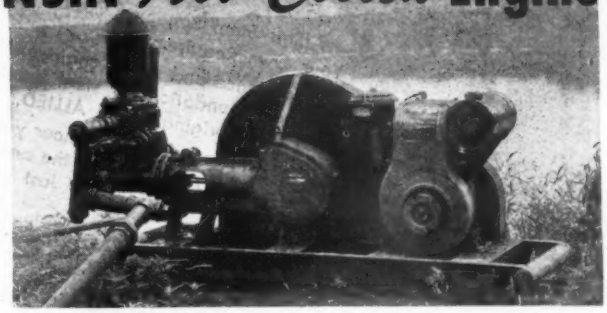

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as this deepening of old wells is not reflected in any development statistics. The number of completions and new locations staked in California during the past several weeks has been smaller than usual and the wells are located in fields where relative deep drilling is required.

CALIFORNIA WILDCAT FAILURES

Kern County, Round Mountain: Independent Exploration Co. and Universal Consolidated 2 fee, 36-27s-28e, bottomed in hard gray sand, Vedder sand of Miocene age 1,360 ft. was barren. TD 1,400 ft.

Los Angeles County, Castaic: C. C. M. Oil Co. 1 Sanborn, 6-3n-16w, bottomed in gray sand of low permeability, only minor showings, TD 8,171 ft.

Newhall Potrero: Barnsdall 1 Wolfson, 26-4n-17w, bottomed in gray sand, upper sands were gray and barren, TD 9,508 ft.

MISSISSIPPI

Gilbertown Getting Three New Oil Wells

JACKSON.—The Gilbertown pool of Choctaw County, Alabama, is getting three new oil wells this week, one being completed, and two waiting on storage. Another possible well, the Carter Oil Co. 1 Sam Alman unit, SW SE NE 5-10n-3w, has run tubing to total depth of 3,370 ft., and is swabbing to test.

In the Gwinville field of Jefferson Davis County, Mississippi, Gulf Refining Co. 1 Buckhalter, in 27-9n-19w, is being completed as a condensate producer, after repeated efforts to complete it as an oil well failed. Completions this week numbered 10, with 4 oilers and 6 dry holes, including 3 dry wildcats. Five new locations have been announced, including one wildcat each for Jeff Davis and Smith counties.

MISSISSIPPI WILDCAT FAILURES

Bolivar County: O. W. Killam 1 Dattel, SW SW NE 18-23n-7w, TD 5,114 ft., Eutaw 4,503 ft.

Jeff Davis County: Humble 1 Williams & Sons, SE SE NW 13-7n-18w, dry, TD 10,426 ft., Chalk 7,055 ft.

Wayne County: Woodley Petroleum and Premier Oil Refining 1 U.S.A., 460 ft. west and 660 ft. north of SE cor. SW 28-7n-9w, dry, TD 7,925 ft., Comanche 7,818 ft.

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OHIO, KENTUCKY

Richfield Center Pool Extended One Half Mile

COLUMBUS.—Ohio Fuel Gas Co. 1 Elza Reisinger, Lot 26, Litchfield Township, Medina County, extends the Litchfield Center pool ½ mile northeast. Clinton sand at 2,738-46 ft. gaged 3,220,000 cu. ft. with a rock pressure of 1,200 lb.

Preston Oil Co. 1 Leonard Collard, Section 11, Newton Township, Muskingum County, made both oil and gas in a test along the west side of the township. Clinton sand at 3,307-50 ft. gaged 230,000 cu. ft. with 42 bbl. oil after shot.

In the Somerset area, Foraker et al 1 D. C. Deaver, Section 10, Reading Township, Perry County, was completed as a good gas well. Clinton topped at 3,088 ft. gaged 1,010,000 cu. ft. Drilling was stopped when the sand started to show oil.

Twenty-two locations were reported for the week with Lancaster field leading with seven. Cambridge field led in completions with 6 out of 23.

WILDCAT FAILURES COMPLETED IN OHIO

Lorain County, Henrietta Township: McManaway & Harmon 1 Silas Bochs, Lot 2, Clinton, no sand, TD 2,206 ft.

WESTERN KENTUCKY

OWENSBORO.—Five oil wells, one gas well and six dry holes were completed in western Kentucky during the past week. A wildcat 2½ miles southeast of Poole, in Webster County, is an estimated 100-bbl. well in Benoist sand.

SUCCESSFUL WESTERN KENTUCKY WILDCAT

Webster County: Ashland 2 Busby, SE NW 12-N-23, 2½ mi. SE of Poole, Benoist sand 2,410-16 ft., TD 2,446 ft., shot with 85 qt., flowed an estimated 100 bbl. in 24 hours. An extension well to the Poole field.

WESTERN KENTUCKY WILDCAT FAILURES

Henderson County: Basin Drilling and W. Chenault 1 Cox, 25-P-27, ¾ mi. N of Curdsville, dry at 2,100 ft. No log. No shows of oil throughout.

Gulf Refining 1 Arvin, W½ SW NE 8-P-23, SW of Henderson, dry at 2,628 ft. No log.

Daviess County: Ziffrin & Anton 1 R. Y. Cravens, 20-N-28, 1 mi. N of Glenville, dry at 1,480 ft. (estimated depth). No log.

INDIANA

EVANSVILLE.—Two relatively small producers and one dry hole were completed in Indiana during the week in review.

In Gibson County, Ryan Oil Co. 1 F. G. Putnam, NE NE NW 26-1s-12w, about 2

miles southeast of Mt. Carmel, Ill., and a wildcat, was showing encouragingly. Saturation in the Hardinsburg sand at 1,790-96 ft. was given a 2-hour drill-stem test with a recovery in 30 minutes of 300 ft. of clean oil, 180 ft. of oil-cut mud and 150 ft. of salt water. It is 2½ miles from production.

Four miles southeast of Mt. Carmel, Deep Vein Coal Co. 1 fee, NE NE SE 1-2s-12w, Gibson County, flowed 134 bbl. in 24 hours from Benoist sand at 2,124-38 ft., the total depth. It was not yet a completion, but it opens a pool.

No wildcat completions were reported in the state during the week.

KANSAS

Five Wells Drilling In Pleasant Pool Area

ELLIS County's new Pleasant pool, discovered in September 1944 by Sunray Oil Corp. 1 Orth, NE NE SW 2-14-20w, is one of Kansas' most active areas. Five wells are now drilling, and 10 wells are producing. A south extension to the pool, in the process of completion, is Sunray Oil Corp. 1 Josephine, NE NW NW 11-14-20w, which is making 12½ bbl. per hour from the Reagan sand. All wells in the pool produce from the Reagan.

Elsewhere in Ellis County, four wildcats are drilling, three of which have shows of oil. Good saturation was logged in the top of the Arbuckle at Phil-Han et al 1 Nicholson, SE SE NW 30-11-20w, and 5-in. pipe has been set at 3,847 ft. Another rank wildcat is the Herndon Drilling Co. et al 1 Schneider, CEL SE SW 6-11-20w. A show of oil was logged in the Lansing at 3,545-47 ft., and operators are drilling below 3,600 ft.

One mile west of the Gorham pool, Cinoil, Inc. 1 Berens, SE NW NW 1-14-16w, has reported a show of 2 bbl. of oil per hour, and operators are testing. The oil was from the Lansing, the Arbuckle being found dry. About 3 miles west of the Pleasant pool, B & R Drilling Co. 1 Gable, NW NW NW 5-14-20w, is plugging back to test shows in the Marmaton and Lansing, after finding water in the Reagan.

In Rooks County, Phil-Han 1 McClellan, NW NW SW 9-9-19w, a wildcat about 2 miles west of the Barry pool, swabbed 12 bbl. of oil per hour natural from the Lansing at 3,343-48 ft. Operators have acidized and are testing.

KANSAS SUCCESSFUL WILDCAT

Ness County: New oil pool—Chalmette Petroleum 1 Bowman, NW NW NE 31-19-25w, physical potential 400 bbl. from Mississippi lime at 4,553-83 ft., TD 4,583 ft., Kansas City 3,933 ft., Mississippi 4,551 ft.

KANSAS WILDCAT FAILURES

Butler County: Zephyr Drilling 1 Stone, SE SE NE 23-24-7e, dry, TD 2,750 ft., Mississippi lime 2,734 ft.

Marion County: Rook Hall Operating Co. 1 Grace, N½ NW SW 11-22-5e, dry, TD 3,014 ft., Arbuckle 2,923 ft.

McPherson County: Sharon Drilling 1 Raussmussen "A," NW NW NW 23-18-1w, dry, TD 2,823 ft., Mississippi chat 2,802 ft.

FOREST CITY BASIN

ST. JOSEPH.—In the Ogle pool of Richardson County, Nebraska, R. S. Tomer Production Co. is deepening the old Power Oil Co. 1 Albin in SW SW 10-1n-14e. This was a small Hunton lime producer drilled in 1941. The Tomer company also will deepen the old Power 2 Bohrer in E½ SE SW 10-1n-14e, to Viola and Wilcox.

Fell & Reed 1 Fred Klam, SE SE SE 19-51n-33w, Platte County, Missouri, is a dry hole. Elevation was 981 ft. Mississippian was topped at 957 ft. and Arbuckle at 1,714 ft. Total depth was 1,750 ft. An unsuccessful attempt was made to plug back to Mississippian and establish gas production.

MICHIGAN

Twenty-Acre Spacing Set For Douglass Field

SAGINAW.—Except for two small Bay County completions, Michigan oilfield activity was without results, six of eight other dry-hole completions being wildcat failures, while two new gas wells were drilled and a dozen new drilling locations were announced in 10 counties. Failures included Shell Oil Co., Inc. Livingston County wildcat deep test in Conway Township, where operations ended with the hole at 4,356 ft. Two of the new locations are in Arenac County, two in Mecosta, the others in Livingston, Roscommon, Kalamazee, Ottawa, Newaygo, Huron, Muskegon, and Montcalm.

The state oil-advisory board has set a 20-acre unit on an NE-SW diagonal new Douglass field in Montcalm County.

Interest turned on natural gas and the state public utilities commission decided to intervene in behalf of a proposed Michigan-Wisconsin Pipeline Co. project which would build a 1,075-mile line from the Texas Hugoton field to the Austin fields in Michigan, as competition for

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Panhandle Eastern, now sole supplier of outstate gas for Michigan. The commission has been trying to induce Panhandle to increase its allotments to Michigan.

MICHIGAN WILDCAT COMPLETIONS

Allegan County: Hopkins Township: Albert Maring 1 Walter Stone, NE SW SE 6-3n-12w, dry, TD 970 ft.

Laketown Township: P. K. Degenthaler 1 William Ash, NE NW NE 14-4n-16w, dry in Traverse limestone, TD 1,506 ft.

Kalamazoo County, Brady Township: Wadsworth & McClure 1 S. R. Brockaway, NE NE SE 17-4s-10w, dry in Traverse limestone, TD 1,201 ft.

Livingston County, Conway Township: Shell Oil Co., Inc. 1 G. W. Wilkinson, NW SE SW 36-4n-3e, dry, TD 4,356 ft.

Muskegon County, Holton Township: H. C. Nelson 1 Stanley Neilander, NW NW SW 8-12n-15w, dry in Dundee, TD 2,675 ft.

Tuscola County, Vassar Township: E. Edwin Brehm 1 Joe Fontana, NW NW NW 34-11n-8e, dry in Dundee, TD 2,850 ft.

LA.-ARK.

Stephens Gets Extension And One New Oil Well

MAGNOLIA. — The Stephens area of Columbia, Nevada and Ouachita counties has a 1-mile extension in the process of completion and one new oil well completed this week. The extension is in Nevada County, J. B. Warmack and W. C. Partee 5 Lester Realty Co., SE N½ NW 36-14s-20w. The well produced 20 bbl. per day with no water from open hole, total depth 2,100 ft. The new oiler is R. H. Crow, trustee B-3 Smart, in 13-15s-20w, which produced 185 bbl. per day from the Smackover.

Completions in Arkansas numbered only three, two oil wells, and one dry wildcat. In the North Louisiana fields, three oil wells, four gas wells and one dry wildcat comprised the completions. The oil wells were in De Soto-Red River, Delhi and Bellevue pools.

ARKANSAS WILDCAT FAILURE

Calhoun County: R. H. Crow 1 Southern Co., NE NE SW 26-14s-14w, dry, TD 2,856 ft.

NORTH LOUISIANA WILDCAT FAILURE

Caddo Parish: United Carbon Co. 1 T. G. Grayson Lumber Co., 660 ft. north and 1,972 ft. west of SE corner of 30-19n-15w, dry, TD 6,161 ft.

OKLAHOMA

Prospective New Pools In Noble and Kiowa

DEEP ROCK OIL CO. 1 Arrendell, SW NW SW 12-23n-1e, Noble County, Oklahoma, a wildcat 6 miles north of the East Otoe pool, appears to have opened a Wilcox sand pool. The sand was topped at 4,574 ft., total depth of the hole 4,600 ft. A 40-minute drill-stem test at 4,583-4,600 ft. developed 1,100 ft. of oil, 100 ft. of oil-cut mud and 50 ft. of slightly brackish water.

Fox & Fox had not yet completed their pool opener in Kiowa County, 1-A Pound, NW SW SW 36-7n-14w, which had been showing signs of production since the middle of September. On a recent pumping test the well produced 115 bbl. of fluid, 96 per cent oil, the remainder sediment and water. Total depth was 810 ft., but the name and depth of the producing formation was not learned.

Phillips Petroleum Co. 1 Duke, SW SW SW 28-5n-8w, Grady County, west of the Chickasha field and southeast of the Cement field, was drilling below 10,632 ft.

In the neighborhood of the Washington pool in McClain County, opened by Carter Oil Co., that company's 1 Vierson, C SE NE 8-7n-3w, was drilling at 9,050 ft. Same company's 1 Autrey, C SE SW 9-7n-3w, had Hunton lime top at 9,696 ft. and was drilling at 9,842 ft., still in Hunton lime, with no showings. Carter 1 Mottinger, C NW NW 6-6n-3w, topped Hunton lime at 9,905 ft. and took a core at 9,943-51 ft. recovering 1½ ft. of hard dry lime, and was still drilling in the Hunton at 10,136 ft. A fourth wildcat in the area, Carter 1 Hawkins, C NE NE 34-6n-3w, which had Hunton lime top at 8,224 ft., was drilling at 8,225 ft., the formations penetrated running high.

In the old Wilzetta pool in Lincoln County, C. L. McMahon, Inc. 1 Ruebac, C N½ NW NW 2-12n-5e, which flowed 580 bbl. in 24 hours after acidizing with 3,000 gal. has been given a pipe-line connection. It produces from the Wilcox and dolomitic zones.

Up to the close of the past calendar week there were 650 Hunton lime oil wells in the West Edmond four-county field, which has been developed on a one-well-to-40-acre basis. In addition there are 12 wells producing oil from Bartlesville sand and three gas wells. Eighteen dry holes have been drilled in the field.

OKLAHOMA WILDCAT FAILURES

Canadian County: J. E. Trigg 1 Tennery, NE SW 22-13n-7w, dry, TD 10,731 ft., second Wilcox 10,625 ft.

Osage County: Jacques Braunstein No. 1,

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Tulsa 1, Oklahoma

SE SE SW 27-25n-6e, dry, TD 2,888 ft., Burbank zone 2,850 ft.

Pontotoc County: Robb 1 Dunn, SE SE NW 23-3n-4e, dry, TD 2,084 ft.

CANADIAN FIELDS

North Offset Scheduled For Hay Lake Dome Test

CHATHAM.—On the Hay Lake Dome in southern Alberta, 3½ miles north of the Montana border, Admiral-British Dominion 1, LSD 7, 22-1-17w4, finished at 3,094 ft. with Madison contact at 3,088 ft. swabbed better than 10 bbl. an hour of amber-colored 29°-gravity crude after acid wash of 500 gal. The Sunburst sand, productive in the Kevin and Cutbank fields of Montana, was water free but too tight to yield oil, and production is coming from 1 ft. of porosity in the Madison. Location is near the crest of the Hay Lake Dome and west of the former international Red Coulee field. Definite pumping tests are being started, with indications of 150 to 200 bbl. flush. An offset will be drilled to the north.

Brazeau.—On the Brazeau structure in the northern foothills, Home-Brazeau 1, SW¼ 17-43-17w5, is in Kootenay below 8,898 ft. after getting the Dalhousie sand at 8,860 ft. The log indicates near approach to the Madison limestone with prospects of getting the potential producing horizon at a favorable depth. The location is on the foothills belt about 85 miles northwest of Turner Valley but structural conditions and potential producing formations are similar, though tests heretofore have required deeper drilling.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, 25, D. C. Notice is hereby given that sealed bids will be received until noon on October 29, 1945 for land described herein, situated within the known geologic structure of the Big Muddy Field, Wyoming. This land is offered to qualified bidders of the highest cash amounts per acre as a bonus for the privilege of leasing the land under section 17 of the leasing act as amended by the Act of August 21, 1935 (49 Stat. 674, 30 U. S. C. sec. 226) in the following parcels, all in T. 33 N., R. 77 W., 6th P. M.; Parcel No. 1, sec. 12, SE¼NE¼, 40 acres. Parcel No. 2, sec. 12, SW¼, 160 acres. Parcel No. 3, sec. 13, NE¼, 160 acres. Parcel No. 4, sec. 13, NW¼, 160 acres. Total 520 acres. Bids must be submitted on each parcel separately; but if two or more parcels are awarded to the same bidder, they may be included in a single lease. Each bidder must submit with the bid one-fifth of the amount bid in cash, or by certified check made payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease, required under 43 CFR 192.19. The envelopes should be plainly marked, "Bid for Parcel No. ..., Big Muddy Field, Wyoming. Not to be opened before noon, October 29, 1945." No bids received after the hour fixed herein for the opening of bids will be considered. The remainder of the bonus and the annual rental at the rate of $1 per acre must be paid and a $5,000 corporate surety bond must be furnished by a successful bidder prior to the issuance of a lease. The deposits of the other bidders will be returned upon acceptance of the successful bids by the Secretary of the Interior. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin, and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

A producer at this point would open an extensive area in the Central foothills for development.

Steveville.—In the Steveville-Princess field, eastern Alberta, Empire-Pacific 2, LSD 16, 22-19-12w4, finished a gasser with production at 3,314-18 ft. and supplying fuel for drilling National-Empire 1 in the same field, is making 55 bbl. of fluid, mostly oil, on the separator with indications that oil is increasing.

Lloydminster.—In the Saskatchewan section of the Lloydminster field, Shaw Petroleums-Chapman 1, LSD 13, 11-49-28w3, is testing oil production at 1,901-4 ft.

ROCKY MOUNTAIN

Cat Creek Pool Staging Comeback With New Pay

DENVER.—Cat Creek, the oldest oil field in Montana, which is now down to 265 bbl. per day after having produced more than 15,000,000 bbl. of light oil in the past 25 years, gave evidence this week of staging a comeback when a discovery was made in a deeper horizon. Shrock 1 Fifer, NW NW NW 21-15n-30e, less than ½ mile northwest of the discovery, which came in on February 19, 1920, for 50 bbl. per day at approximately 1,200 ft., topped the Ellis sand at 1,393 ft. and at 1,395 ft., 2 ft. in the pay, flowed 15 bbl. of 52-gravity oil per hour. The Ellis underlies the entire field and if the new well holds up to initial indications, Cat Creek may be restored to its former prestige.

Weld County deep test.—Location for an important wildcat in the Buckingham District, Weld County, northeastern Colorado, is reported to have been made in the NW NW 15-7n-59w, to be drilled by Fred M. Manning, Inc., for its joint account with the Dickey Oil Co. This is on what formerly was known as the Ramsey block. Location is ¾ mile northwest of 1 St. Anthony, drilled by Ramsey Petroleum Co. in 1932. This well had 6,000,000 cu. ft. of gas in the Muddy sand at 6,680-6,700 ft., and drilling continued to 6,790 ft. It topped the Dakota at 6,760 ft. and found saturation in the first 5 ft. of sand and swabbed 40 bbl. in 24 hours. It then drilled more Dakota sand at 6,768-74 ft. which carried water. Unable to shut off the water, it was plugged back to the Muddy and completed for 4,000,000 cu. ft. of gas. After being shut in until 1939, the hole was junked and in pulling the casing it showed considerable fluid, about 25 per cent oil. Next year Ramsey drilled a mile to the southwest in 1 Scriven and found water in the Dakota at 6,891-94 ft., running 20 ft. lower than the St. Anthony well. In 1942 Ramsey drilled a west offset to the discovery and abandoned it at 7,006 ft., finding water in the Muddy and Dakota.

Barker Dome gasser.—Southern Union Production Co. 11 Barker Dome, SE NW 16-32n-14w, San Juan County, northwestern New Mexico, was completed at 9,004 ft., with the 5½-in. at 9,000 ft., for 41,000,000 cu. ft. of gas per day. It marks an extension 1 mile north of the discovery well in the lower Pennsylvanian, and is the second well drilled to that horizon.

New operations.—Ten new operations were reported, of which one, a wildcat in Weld County, is in Colorado; two, one each in Lance Creek and Oregon Basin, in Wyoming; seven in Montana, two in Cut Bank and three in Kevin-Sunburst, and two wildcats, one each in Fergus and Yellowstone counties.

Completions.—There were 24 wells completed, of which 13 were oil wells with an initial production of 1,183 bbl. per day, 8 were dry and 3 were gas wells. These were distributed: One oil completion in Colorado, 2 oil wells and 5 dry holes in Wyoming; 11 oil wells, 2 gas wells and 1 dry hole in Montana, and 1 gas well and 1 dry hole in New Mexico. Five wildcats were completed, of which four were dry and one was a gas well.

WYOMING WILDCAT FAILURES

Hot Springs County, Cedar Ridge: Husky Refining 1 Gov't., NW SE NE 28-43n-95w, TD 1,250 ft., through Madison, dry.

Park County, Elk Basin: Mackinnie Oil & Drilling 1-B Tendolle, NE NW SE 32-58n-98w, TD 5,759 ft., top Embar 3,511 ft., drilled through fault and back into Dakota, 75 degree dips, dry.

Uinta County, Whitney Canyon: Joe Minton No. 1, NW NE NE 24-17n-120w, TD 2,017 ft., dry.

Albany County, Centennial: Trigood Oil Co. 1 May, SE NW NE 5-15n-77w, TD 1,122 ft., encountered fault at 780 ft., dry.

NORTHWEST NEW MEXICO SUCCESSFUL WILDCAT

San Juan County, Barker Creek: Extension to Barker Creek—Southern Union Production Co. 11 Barker Creek, SE NW 16-32n-14w, TD 9,004 ft., 5½-in. 9,000 ft., 41,000,000 cu. ft. of gas from lower Pennsylvanian, 1-mile extension.

NORTHWEST NEW MEXICO WILDCAT FAILURE

Santa Fe County, Grant: E. S. Adkins 1 Bashor, SW NW NW 23-12n-11e, TD 977 ft., dry in granite.

CALENDAR

October

American Gas Association, annual meeting, Engineering Societies Building, New York, October 24-25.

Petroleum Electric Power Association, annual meeting, Dallas, October 30-31.

November

Pacific Ssection, American Association of Petroleum Geologists, annual fall meeting, Ambassador Hotel, Los Angeles, November 8-9.

American Petroleum Institute, annual meeting, Stevens Hotel, Chicago, November 12-15.

Independent Natural Gas Association of America, annual membership meeting, Dallas, November 26.

December

Michigan Oil and Gas Association, annual meeting, Mt. Pleasant, December 3.

Interstate Oil Compact Commission, Wichita, Kans., December 13-15.

(1946)

February

American Welding Society, national meeting, Hotel Cleveland, Cleveland, February 4-7.

Iron and Steel and Institute of Metals divisions, American Institute of Mining and Metallurgical Engineers, national meeting, Statler Hotel, Cleveland, February 4-8.

American Society for Metals, annual convention (postponed from 1945), Statler Hotel, Cleveland, February 4-8.

Exposition of Chemical Industries, twentieth exposition, Grand Central Palace, New York, February 25-March 2.

April

American Association of Petroleum Geologists, annual meeting, Stevens Hotel, Chicago, April 2-4.

Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas, April 17-19.

May

National Association of Corrosion Engineers, annual meeting, President Hotel, Kansas City, Mo., May 7-9.

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Among the

Drilling Contractors

Hupp & Hume, Owensboro, Ky., are contractors for Sohio Petroleum Co. 5 Dixon, 21-O-22, a location in Henderson County, Kentucky.

Stuart Godfrey has the contract for P. F. Broughton 1 Rayman, NE NW SW 21-1s-12w, a wildcat in Kalamazoo County, Michigan.

D. & G. Oilfields Specialties, Ltd. has been organized with laboratories at Calgary to specialize in water, core, and petroleum analysis, for drilling and producing wells. The company is directed by Ken Doze and W. E. Griffiths, of Calgary.

Joe May will drill the J. W. Carter-E F. Moran 1 Hamilton, 24-P-27, near Hamilton Ferry in Henderson County, Kentucky.

Krumac Drilling Co., Fort Worth, has been awarded the contract to drill Eltex, Ltd. 2 Martin, 330 ft. from the north and 990 ft. from the west lines of Section 174, Block 72, Abstract 1705, a 4,500-ft. test in Concho County, Texas.

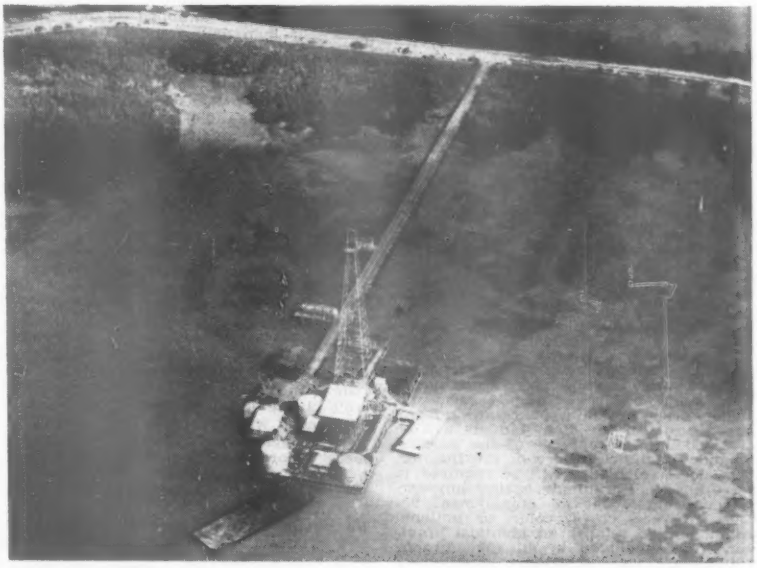
Gordon Oil Co. is the contractor for two Deep River pool tests, the Fletcher & Leman 1 Smith, NE SE SE 15-19n-4e, and the Fletcher & Leman 4 Smith, SE NE SE 15-19n-4e, in Arenac County, Michigan.

Sidwell & Myers, Midland, Tex., have the contract for R. R. Herrell et al 1 Burton-Lingo Co., 5½ miles west of the Hendrick field, in Section 27-27, PSL, a test in Winkler County, Texas.

Ace Gutowsky has been awarded the contract to drill a new Wilcox sand test in southwestern Grant County, Oklahoma. The location is S. M. Stauffer 1 Hall, NE NE SE 9-25n-7w.

Shafer-Toler Drilling Co., Flora, Ill., is the contractor for William P. Muller 3 Ruppel, 990 ft. from the north line and 330 ft. from the west line of NW NE 1-1n-11w, a test in Knox County, Indiana.

E. F. Moran, Tulsa, has the contract to drill the Continental Oil Co. 72 Maier, 330 ft. from the north



View of drilling rig of Al Buchanan Drilling Co., operating in Florida, on the O. D. Robinson 1 State, in 29-59s-40e, Monroe County. Until last month this was the farthest south any rig was operating in the United States. During the recent hurricane the derrick was blown over, but it has since been rebuilt

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line and 330 ft. from the east line of NE SE 11-3s-14w, in Gibson County, Indiana.

Robert W. Atha is the contractor for Gulf Refining Co. 4 Bottorff, S½ SW NE 1-16n-8w, a Fork pool test in Mecosta County, Michigan.

C. E. O'Neal, Evansville, Ind., is rigging up rotary to drill Ashland Oil & Refining Co. 6 Payne, 7-O-21, in Union County, Kentucky.

George & Wrather Drilling Co., Mt. Carmel, Ill., will drill the Deep Vein Coal Co. 1 Citizens National Bank of Paris, Ill., et al, NW NW SW 6-2s-11w, in Gibson County, Indiana.

Hayes Drilling Co., Mt. Carmel, Ill., has the contract for Ryan Oil Co. 1 Kries, NW SE SE 8-3s-13w, in Gibson County, Indiana.

F. W. Potts & Son have the contract for Alpha Oil Co. 1 Itsell, W½ SE SE 5-2n-5e, a wildcat in Livingston County, Michigan.

E. F. McIntire has the contract for E. L. Bourret 1 Conway, NW NW NW 15-14n-14w, a wildcat in Newaygo County, Michigan.

Ajax Drilling Co. has the contract for two wildcats in Isabella County, Michigan. They are Sohio Petroleum Co. 1 Gilmore Gas Unit Commission, SE NW NW 25-16n-5w, and 2 Gilmore Gas Unit Commission, SE NW SE 26-16n-5w.

Merrill Drilling Co. will drill the J. V. Wicklund Development Co. 1 Smith, NW NW SW 29-13n-4w, a wildcat in Isabella County, Michigan.

- Makes rod-changing *easier* and *quicker*, because it provides a positive, convenient grip on the insulator.
- Holds small rods upright and away from work.

See your local distributor.

The Multi-range *lightweight* BJ Type "T" Tong for Drilling or Production Rigs

Designed to lighten and speed up the job of running tubing, BJ type "T" tongs are equally valuable in "nippling up" or as lay tongs. Made in five series: A, B, C, D, and E, with available jaws in each series to handle API tubing and coupling sizes from 1" to 4", plain or upset.

Change in size of tong jaws can be made quickly and easily. The dies are self sharpening and provide a quick, positive, non-crushing grip. The handle is made of reinforced seamless tubing, and is designed to provide sturdy, balanced construction. Stabbed on, these tongs cannot come open even if hinge pin fails, yet jaws easily release by pulling back on the sleeve. Call your BJ supplier and let him equip your rigs with "T" tongs.

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Houston • LOS ANGELES • New York

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Pipe Stringing

I. C. C. Authority — heavy hauling — Colorado, Wyoming, Montana, North and South Dakota. Pipe lining — building & construction — derrick skidding. Trucks — tractors — trenchers and welders.

Baroid products in stock at Riverton and Rawlins, Wyoming, and Craig, Colorado.

DAWSON & CORBETT
RAWLINS • Box 288 • WYOMING

PERSONALS

He's Seen 22 Years Of California Oil Development

E. L. DAVIS, who recently became general production superintendent of Signal Oil & Gas Co., has seen 22 years of California oil development. Not only seen it, but taken an active part in it. Davis entered the oil business in 1923, following his graduation from Stanford University with a degree in geology. For the first 3 years he served as a petroleum engineer, first with Chanslor Canfield Midway Oil Co. and later with Miley Oil Co. From 1926 until 1941 he was with The Texas Co. in California, and was a district engineer for that company in Long Beach when he joined Petroleum Administration for War, District 5, as chief of the petroleum production section. He was appointed assistant director of the production division in May 1943, and a year later he became director. He served in that capacity until his resignation to join Signal.

Davis is a former chairman of the Long Beach chapter of American Petroleum Institute and a former vice chairman of the institute's Pacific Coast district, division of production.

Herman K. McKinnon has been elected secretary-treasurer of Permian Basin Engineers Association to fill the unexpired term of the late Thomas J. Speed. McKinnon is with the Midland, Tex., production office of Shell Oil Co., Inc.

Aubrey T. Gholson, returning from the armed forces, is now associated with Hovey Petroleum Co., Houston. Gholson formerly was a deputy petroleum inspector approved by the New York Produce Exchange and was identified with petroleum inspection work, foreign and domestic, for 12 years.

R. N. Keppel, president of Standard Oil Co. of Pennsylvania, has been appointed general manager of marketing for Standard Oil Co. of New Jersey. He also was elected a vice president and director of the company. He succeeds **J. E. Skehan,** who will continue as a director until

R. N. KEPPEL

E. H. COLLINS

January 1, when he plans to retire, following 43 years' service. Keppel joined Standard of New Jersey 25 years ago as director of training at the Bayonne, N. J., refinery. He has been serving as southern region sales manager. He is succeeded in that post by **E. H. Collins,** a vice president and director of Standard of Pennsylvania and formerly assistant northern region sales manager. Collins joined the parent company 26 years ago as a record clerk in Baltimore.

DR. C. L. THOMAS

Dr. Charles L. Thomas has been appointed director of research for Great Lakes Carbon Corp., Chicago, and **Dr. L. C. Swallen** assistant director. Dr. Thomas joined the Great Lakes staff recently after 14 years in the laboratories of Universal Oil Products Co. He is a graduate of University of North Carolina and received his doctor's degree at Northwestern University. Dr. Swallen, who joined Great Lakes 3 years ago, received his doctorate from Ohio State University.

J. F. McMANMON

Brig. Gen. James F. McManmon, Air Corps, who held an executive position with Hanlon-Buchanan, Inc. of Tulsa, has been awarded the Legion of Merit, the War Department announces. The presentation was made by **Lt. Gen. Ira C. Eaker,** formerly of Durant, Okla., and now chief of air staff at headquarters in Washington. General McManmon was commissioned a major in October 1942 and a brigadier general in September 1945. He is out of the country on an undisclosed mission.

AL BUCHANAN

Al A. Buchanan, of San Antonio, president of Al Buchanan Drilling Co., has been named chairman of the newly created Texas Aeronautical Commission. The other members are **Parker F. Prouty,** of Lubbock, vice chairman, and **Henry Ayres,** of Paris. Buchanan, who operates 10 drilling rigs, has other oil interests also, and he has been using his own planes 15 years. Ayres too owns a plane and is a pilot.

E. G. Harman, formerly in the geological and land department of A. G. Hill Co., Dallas, has joined Republic Natural Gas Co.'s geological department in that city.

John F. Dodge, petroleum engineering consultant and since 1929 head of the division of petroleum engineering at University of Southern California, has joined Pantepec Oil Co. of Venezuela, C. A., as vice president and manager, with headquarters in Caracas. He will retain his association with the university. For years Dodge was petroleum engineer with Kern Trading & Oil Co., Pacific Oil Co.,

PUMPS for PETROLEUM PRODUCTS

Write for Bulletin 102— Pumps for the Petroleum Industry

It will tell you why

BLACKMER ROTARIES

are SELF-ADJUSTING FOR WEAR

GATHERING PUMPS
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HAND PUMPS
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Capacities to 750 GPM.
Pressures to 500 psi.

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COMBINING in one organization the largest and most complete geophysical research facilities in the world together with unexcelled equipment, experienced field crews and proven interpretation technique, Western Geophysical Company meets every requirement of operators desiring a *complete* and well-rounded geophysical service.

Western's seismic and gravity crews are now operating in all parts of the United States and in South America. Western service is available for surveys in any part of the world. Inquiries are invited.

Western GEOPHYSICAL COMPANY
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EDISON BLDG., LOS ANGELES 13, CALIF.
FIRST NATIONAL BANK BLDG., DALLAS 2, TEXAS
118 COMMERCE ST., NATCHEZ, MISSISSIPPI

and Standard Oil Co. of California. He has visited and studied oil fields of Burma, Sumatra, Java, and Venezuela, besides many in North America.

Brig. Gen. Walter B. Pyron, vice president of Gulf Oil Corp., who recently received his discharge from the Army after almost 5 years' service, has been named head of all producing operations of the company in Europe and the Near East. After a short rest at his home in Houston he will leave for London, to open headquarters there January 1. General Pyron was coordinator of fuel and gasoline supplies for the Army and Navy from October 1941 until his discharge, with offices in Washington. He was awarded the Legion of Merit for outstanding service "representing the American petroleum industry."

W. F. Stroud has been named plant manager of The Atlantic Refining Co.'s Philadelphia refinery, succeeding **Howard M. Nichols,** who retired. **D. T. Shaw** has been appointed assistant plant manager.

E. L. DeMaris, of General Petroleum Corp. of California, has been appointed assistant manager of the geological department with headquarters in Los Angeles and jurisdiction over exploitation activities, succeeding **R. O. Swayze,** who was transferred to the Wyoming division as assistant manager of the production department. **Lowry Wadsworth** has been moved from the San Joaquin Valley to Los Angeles headquarters to become chief petroleum engineer. **Eddie Conen,** formerly district petroleum engineer at Taft, has succeeded Wadsworth in charge of the San Joaquin Valley division.

Charles B. Gale, special assistant to **A. P. Frame,** director of the refining division, has resigned from Petroleum Administration for War to return to private industry. Gale, who went to PAW in July 1942 from Pan American Petroleum Corp. at New Orleans, will be in Pan American Refining Corp.'s research and development department in New York hereafter. He was graduated from University of Illinois in 1928 with a B.S. degree in chemical engineering, and from Massachusetts Institute of Technology in 1930 with an M.S. Gale served as PAW's refining representative on the Petroleum Economics Subcommittee of Petroleum Industry War Council.

ADSCO VERTICAL STEAM TRAPS

NEVER COME OUT OF THE PIPE LINE

All working parts attached to cover

So light that it can be borne entirely by the piping — with valve and float mechanism mounted on cover, and all piping connection on the body, the Adsco Vertical Steam Trap need never come out of the pipe line.

If cleaning or adjustments are necessary the cover with all working parts can be removed quickly without disturbing the piping. By keeping an extra cover with valve assembly on hand this "spare" can be substituted in a few minutes with practically no interruption to service, and the original assembly taken to the work shop for servicing.

Double Life. **This trap also has a reversible valve and reversible seat of non-corrosive stainless alloy steel which gives it double life. Write for Bulletin No. 35-860 and prices.**

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, NEW YORK
Makers of UP TO DATE Steam Line Equipment for Over 65 Years

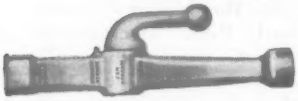
K.O.'d by DUGAS in 37 Seconds!

● In a test conducted for the observation of Underwriters' Laboratories and Factory Mutual Laboratories, 500 gallons of 300 degree F. flash point paraffin oil were "touched off."

This "transil oil" fire was large (20 ft. x 20 ft. area). After burning for 2 minutes, a DUGAS 150-A Wheeled Extinguisher equipped with the *new dual-stream nozzle* was brought into action.

In a mere 37 seconds, the inferno was extinguished.

NEW NOZZLE STEPS UP EFFECTIVENESS



NEW DUAL-STREAM NOZZLE deals effectively with spill fires and fires difficult to reach because of height or obstructions. Designed for use with DUGAS Wheeled Extinguishers, the new Dual-Stream Nozzle greatly increases fire-fighting range and effectiveness. A turn of the handle gives a *straight* stream with a range of 45 feet—or a *fan* stream with a range of 15 feet.

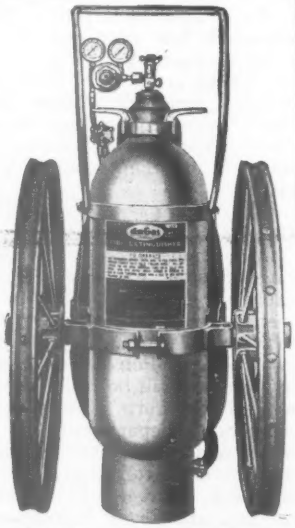
QUICK FACTS ABOUT DUGAS DRY CHEMICAL

1. For extra-hazardous fires involving flammable gases, liquids, greases or electrical equipment.
2. Not an electrical conductor.
3. Non-toxic, non-corrosive, non-abrasive.
4. Not affected by extreme cold or heat.

Write today for complete information regarding DUGAS Wheeled Extinguishers with the new Dual-Stream Nozzle . . . and DUGAS Hand Extinguishers.

AN ANSUL PRODUCT
duGas
THE MASTER OF FLAME

Approved by Underwriters' Laboratories, Factory Mutual Laboratories



DUGAS 150-A WHEELED EXTINGUISHER

ANSUL CHEMICAL COMPANY, MARINETTE, WISCONSIN
DUGAS DIVISION

"Best Bet Yet"

These oil-proof, wear-resistant, plastic tubing protectors are an integral part of the tubing collar. Made in all sizes, they prevent the metal-to-metal contact that has caused many expensive "wet" jobs in pumping wells in the past.

PATTERSON-BALLAGH
TUBING PROTECTORS
LOS ANGELES 1 • HOUSTON 10 • NEW YORK 6

ALTEN
Special Flexible
STUFFING
BOX

Heavy Pattern
Type with
Pumping Tee

Fig. F-658

ONE OF OVER 300
ALTEN OIL FIELD
PRODUCTS

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FOUNDRY and MACHINE WORKS
Established 1889 . . . . . Lancaster, Ohio
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Leading Supply Stores Carry All Alten Oil Field Equipment

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HERSCHEL LEWIS

J. C. RILEY, JR.

L. G. HARRIMAN

Equipment Men in News

Three vice presidents have been appointed for the Ideco sales organization, **O. M. Havekotte**, president of International Derrick & Equipment Co., announces. **Ferguson Barnes** will be promoted to vice president in charge of sales. **H. L. Putnam** will enter the Ideco sales organization as vice president—Mid-Continent direct sales. **G. W. Walton** will be promoted to vice president—machinery sales.

J. C. Riley, Jr., and **Herschel Lewis** have been appointed as assistant managers of sales of the D+B Mid-Continent division of Emsco Derrick & Equipment Co. Riley will be in charge of sales in Oklahoma, Kansas, Illinois, Indiana and Kentucky. Lewis will have charge of sales in Texas, New Mexico, Louisiana, Arkansas, and Mississippi.

Addison F. Vars, president Sterling Engine Co., Buffalo, N. Y., has announced the election of **Lewis G. Harriman**, president of The Manufacturers & Traders Trust Co. of Buffalo to his board of directors.

Master Vibrator Co., Dayton, Ohio, announces the appointment of **Arthur T. Stanton** as general sales director with supervision over all domestic and export sales, sales promotion, merchandising and advertising.

Benjamin F. Fairless, president, has announced the election of **David F. Austin** as vice president, sales, United States Steel Corp. of Delaware. Austin has been acting vice president since June 20, 1945, during which time he continued as vice president in charge of sales, Carnegie-Illinois Steel Corp.

Roy A. Bass has recently been appointed director of distribution of Dresser Industries, Inc., Cleveland, Ohio, a new post. He will be responsible for the national program of Dresser and its member companies in the establishment and expansion of distribution in industrial centers.

Thomas J. Hilliard has been elected vice president in charge of sales of Carnegie-Illinois Steel Corp. Hilliard has been general manager of sales since 1938. He will be succeeded by **J. Douglas Darby**, who has been manager of sales for the company in Philadelphia since 1939. Two other sales department staff changes announced are **Paul Selby** as assistant general manger of sales, and **Wesley C. Bobbitt**, as manager of sales in Philadelphia.

E. A. Koenig has joined Crutcher-Rolfs-Cummings, Houston, Tex., as chief engineer and manager of shop operations. A consulting engineer since June of this year, Koenig was with Magnolia Pipe Line Co. from 1935 until mid-1945, as corrosion engineer and superintendent of butane-gasoline pipe lines. Prior to that he was with Magnolia Petroleum Co., in the natural-gas and gasoline department, as district superintendent, as chief engineer of the natural-gas and gasoline department, and in various other capacities. He is a graduate of Texas A. & M. College.

Brewster Co., of Shreveport, La., manufacturer of oilfield equipment, announces the recent promotion of **James T. Carmichael** to chief engineer.

Grant B. Shipley, chairman of the board of Elliott Co., Jeannette, Pa., announces election of **W. A. Elliott** as president. Elliott has been executive vice president. Shipley, who remains as chairman of the board, previously was also president. **F. H. Stohr**, formerly assistant to the president, was elected executive vice president, and **F. W. Dohring**, who has been general sales manager, was elected vice president in charge of sales. Other executive officers of Elliott Co. include: **R. W. Owens**, vice president in charge of manufacturing; **R. B. Smith**, vice president in charge of engineering; **Dundas Peacock**, controller, and **M. G. Shevchik**, secretary and treasurer.

Announcement has been made by **A. J. Kerr**, general sales manager of Pittsburgh Equitable Meter Co.-Merco Nordstrom Valve Co., that **Waldo S. Hull** has joined the sales division of the company.

George M. Ryerson, field engineer of Plomb Tool Co., has been made regional sales manager for the Michigan, Ohio, and Indiana area.

Larkin Packer Co., Inc., St. Louis, Mo., has recently appointed Hunt Export Co. as export representative. Offices of the selling organization are maintained in New York, Houston, and Buenos Aires, and other offices will be established at other strategic points among export centers for the oil trade as readjustments to normal, prewar conditions are effected. Larkin also announces the appointment of the E. C. Dilegard Co. as sales representative in the Rocky Mountain territory.

Hunt Tool Co., Houston, announces the appointment of **T. H. Salter**, formerly district manager for Bethlehem Supply Co., to the Hunt sales staff. He will be located in Houston.

G. M. Stewart, New York representative of Hunt Export Co., left September 22 for an extended tour of the oil fields of South America following a sales conference in Houston, where the company also maintains an office. Hunt Export Co. recently opened an office in Buenos Aires, Argentina.

William C. Van Cleaf has been appointed director for industrial relations for Allis-Chalmers Manufacturing Co. Prior to his appointment, Van Cleaf served as assistant to **Lee H. Hill**, former head of industrial relations, who resigned.

Republic Steel Corp. has announced the purchase of The Stevens Metal Products Co., Niles, Ohio, manufacturer of steel barrels, drums, and other specialties.

William McNear Rand has been elected president of Monsanto Chemical Co., succeeding **Charles Belknap**, who will continue as chairman of its executive committee. For the last 8 years, Rand has been a Monsanto vice president.

Thermoid Co., Trenton, N. J., has announced the appointment of **Oscar Nuss** as district manager of its Industrial Rubber Products Division. Nuss will serve the Southern California, New Mexico, and Arizona areas.

C. N. Schmidt has been appointed advertising manager of American Steel & Wire Co., subsidiary of U. S. Steel Corp.

A. T. STANTON

DAVID F. AUSTIN

ROY A. BASS

T. J. HILLIARD

E. A. KOENIG

J. T. CARMICHAEL

R. B. McCOLL

W. L. LENTZ

H. BLANKENSHIP

Election of **Robert B. McColl** as executive vice president of American Locomotive Co. is announced by **Duncan W. Fraser**, president. McColl is succeeded as vice president in charge of manufacturing by **W. L. Lentz** of Schenectady who directed the company's vast tank and locomotive manufacturing program there the past 5 years.

Harvey W. Blankenship has been appointed advertising manager of Universal Oil Products Co., Chicago. He comes to Universal from S. C. Johnson & Son, Racine, Wis., where he served as sales promotion manager of the industrial division, and for a number of years prior to that connection he was advertising manager of Graver Tank & Mfg. Co., Inc. In his new position he will direct all activities of the advertising and technical education departments for Universal.

With the appointment of **Lynn Mahan** as assistant to the president in charge of public relations, American Locomotive Co. has established a single department for the company's publicity, advertising, and sales promotion. **H. J. Downes**, who has served as advertising manager for many years and who recently became president of E. Mattes & Son, Inc., will act as technical adviser under the new plan. **Holmes M. Brown**, advertising manager of Pennsylvania Rubber Co., has been named director of advertising, and **Murray O. Smyth**, assistant advertising manager, will serve as assistant director of advertising and sales promotion. **Gordon G. Agnew, Jr.**, formerly of the New York Times and James O. Peck Co., will serve as assistant to Mahan.

Refinery Equipment, Inc., Tulsa, announces the resignations of **W. C. Berry** as president, and **Robert W. Duden** as secretary. These persons were replaced by the election of **Louis G. Galamba** of Kansas City as president, **L. G. Galamba, Jr.**, as vice president and general manager, and **J. W. Moore** of Kansas City as secretary. Refinery Equipment, Inc., now becomes a wholly owned subsidiary of Sonken Galamba Corp. The company will deal exclusively with refining equipment and supplies.

Marshall B. Taft, formerly of the Aero division, Minneapolis-Honeywell Regulator Co., has been made assistant to **Henry F. Dever**, president of Brown Instrument Co., Philadelphia industrial division of the Honeywell organization.

L. H. Gegenheimer, after a 4-year leave of absence for war duties in Washington, is back with The Timken Roller Bearing Co., Canton, Ohio, in his former capacity as sales engineer in the industrial division.

Athey Truss Wheel Co., Chicago, Ill., announces a change in name, effective at once, to Athey Products Corp. **B. F. Lease**, president, also announces its products will bear the trade name, "Apcor." The line will include MobiLoaders, force-feed loaders, rubber-tired trailers, logging cruiser wheels, forged-trak wheels, wagons and trailers, and will be sold through the "Caterpillar" distributor organization.

B. F. Lease, president, and D. F. Hipskind, vice president in charge of sales, discuss change in company name to Athey Products Corp.

J. Harold Merrick has been elected a vice president of Rheem Manufacturing Co. Merrick joined the Rheem organization in 1943 as general attorney and recently was named president of a newly formed subsidiary, Rheem Manufacturing Co. of Brazil, Inc.

After 4½ years in the armed forces, **H. E. Ferrill** has returned to Kerotest Manufacturing Co., Pittsburgh, Pa., as sales and development engineer of the brass division.

Dunlap & Seaman, Houston, Tex., will start construction in the near future of a building in Odessa, Tex., for oil-field-equipment manufacturers and their representatives. The building will be situated on the Odessa-Monahans highway, within 12 blocks of the heart of town. It will be air-conditioned throughout.

J. H. Edmonds, general manager, Lebanon, Pa., plant Bethlehem Steel Co., has retired. **Walter R. Penman**, formerly assistant general manager, succeeds him. **Robert L. Riley**, assistant factory superintendent and and superintendent of the Bethlehem-Lebanon Forge Co. during the war, succeeds Penman as assistant general manager.

Thomas G. Bostic, who was local store manager for Jones & Laughlin Supply Co. at Bruni, Tex., from September 1941 to March 1942 at which time he entered the army, has returned after 33 months overseas. Bostic is to be sales representative for Jones & Laughlin, working out of the Alice, Tex., store.

Harry E. Clark & Co., Shell Building, Houston, Tex., has been appointed by Strong, Carlisle & Hammond Co., Cleveland, as distributor for their full line of steam specialties, including the new "Hi-Cap" inverted bucket traps, open bucket traps, strainers and pressure regulators. Now associated with Harry E. Clark & Co. is **J. Doug Toole**, who has been sales engineer with Norvell-Wilder Supply Co. The Clark company plans to establish a sales and service branch in Dallas in the near future.

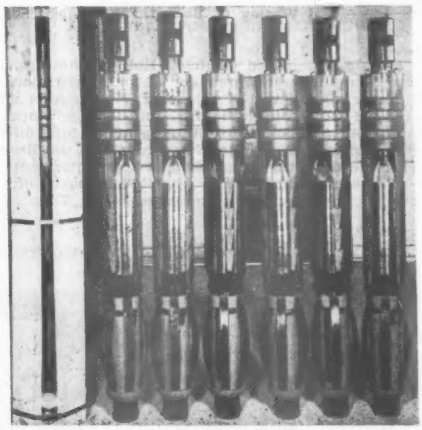
O. M. Hullinger has been appointed manager of the Chicago office of the Elastic Stop Nut Corp. of America, with headquarters at 20 North Wacker Drive.

C. H. Schiller has been appointed manager of market research and sales analysis for American Steel & Wire Co., subsidiary of United States Steel Corp.

Jack Ballagh, secretary and general sales manager of Patterson-Ballagh Corp., is making a 5-week tour of the oil fields of Texas, Louisiana and Oklahoma, making his headquarters at the Patterson-Ballagh offices and warehouses in Houston. Patterson-Ballagh recently announced the association of **R. W. Cypher** as a sales engineer. He will make his headquarters at the company's office and warehouse in Los Angeles.

I. Newton Becker, vice president in charge of sales, engineering and research, for United States Gauge Co., announces the promotion of **W. S. O'Connor** to national field sales manager to assist **L. L. Corcoran**, sales manager. **H. M. Bear** will succeed O'Connor as district manager of sales territory covered by the New York office.

Peerless Pump Division of Food Machinery Corp. has opened an office in Dallas, Tex., 912 Irwin-Keasler Building. **W. E. Griffin** has been appointed manager of the office.



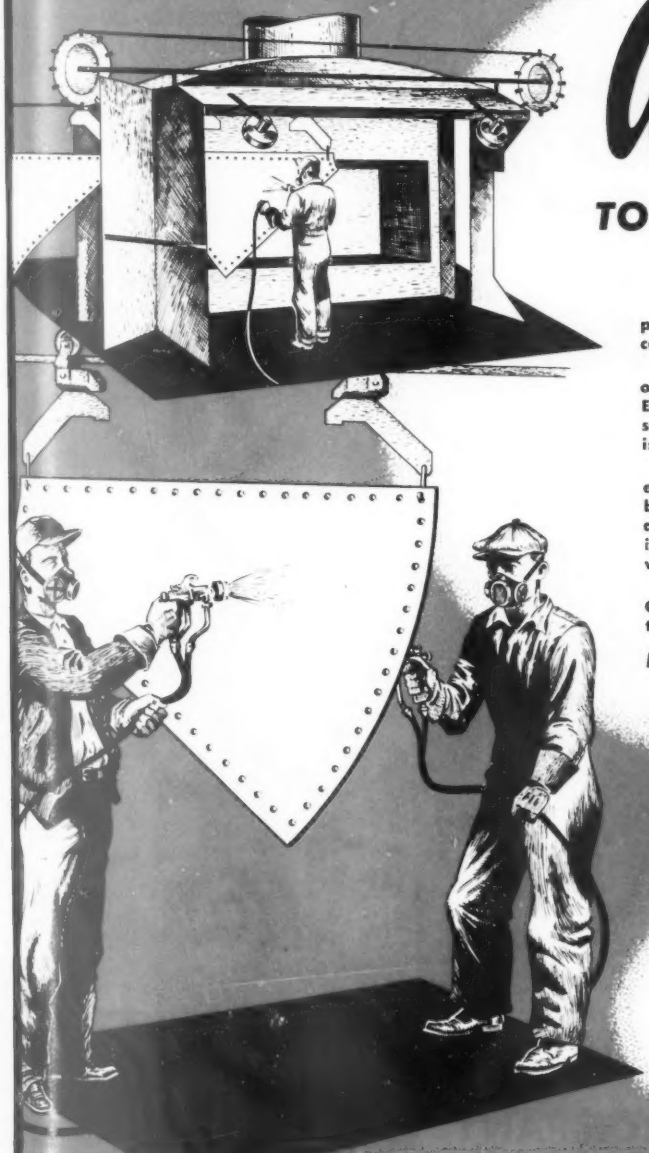
Part of a shipment of large, heavy-duty packers which was recently completed for shipment by Equipment Engineers, Inc., Dallas, Tex., for the Russian Government. Eighteen packers have been made from this design, in sizes from 8⅝ by 3 in. to 8⅝ by 5½ in.

the OIL AND GAS JOURNAL

HOW PROPER PAINTING GIVES

Added Life

TO MALONEY STEEL TANKS



The Maloney Bolted Steel Tank painting process provides a tighter bound double coated surface designed for permanence.

It is tighter bound because each plate is oven heated, by Maloney's EXCLUSIVE PROCESS, to 800° F. to remove all moisture, film, scale, and foreign matter before the paint is applied.

Then, while still hot, the plates are painted with a special chromic primer, followed by a second coat of the highest grade aluminum containing a special rust inhibitive developed by the Navy during the war.

Specify MALONEY bolted steel tanks for QUALITY—your assurance of EXTRA long trouble-free life.

MALONEY TANK MFG. COMPANY
38 No. Peoria
Tulsa, Oklahoma

STOCK AND SERVICE
Available at
Principal Oil Centers

MALONEY

PRICE 20 CENTS

OCTOBER 27, 1945

11-ft. Diameter Fractionating Tower

. . . increases cracking capacity a a Kentucky refinery

This 11-ft. diam. by 76 ft. fractionating tower, one of the refinery towers we designed, fabricated and erected at a refinery in Kentucky, has helped to increase cracking capacity by 50 percent.

We are equipped to handle shop-assembled refinery towers and pressure vessels, built in accordance with ASME or API-ASME specifications, as well as to fabricate and erect refinery towers to your own specifications. When you need additional equipment of this type write our nearest office for quotations.

The view below shows the 11 ft. diam. by 76 ft. tower being erected.

NEW STRESS-RELIEVING FURNACE FOR CHICAGO PLANT

We are now erecting a stress-relieving furnace at our Chicago plant that will take vessels up to 15 ft. in diam. by 83 ft. long. Vessels longer than 83 ft. can be stress-relieved in multiple heats. (The stress-relieving furnace at our Birmingham plant handles vessels up to 13 ft. 2 in. in diam.)

CHICAGO BRIDGE & IRON COMPANY

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PHILADELPHIA • SAN FRANCISCO • TULSA • WASHINGTON • ATLANTA • HAVANA